CALIFORNIA COASTAL COMMISSION
45 FREMONT, SUITE 2000
SAN FRANCISCO, CA 94105-2219
VOICE AND TDD (415) 904-5200
FAX (415) 904-5400

Th9b

August 7, 2003

To: Coastal Commissioners and Interested Public

From: Alfred L. Wanger, Deputy Director
Alison Dettmer, Manager, Energy and Ocean Resources Unit
Tom Luster, Energy and Ocean Resources Unit

Re: **Presentation of Draft Report on Seawater Desalination and the California Coastal Act**

INFORMATIONAL ITEM ONLY

This presentation provides a summary of issues discussed in the draft report titled Seawater Desalination and the California Coastal Act. The report is an update of Commission staff's 1993 report titled "Seawater Desalination in California", and reflects the recent increased interest in constructing and operating seawater desalination facilities along the California coast.

This updated report is meant to serve several purposes:

- To provide general information about the issues related to desalination along the California coast;
- To discuss Coastal Act policies that are likely to apply to various proposed desalination facilities;
- To identify information that is likely to be required during coastal development permit review for proposed facilities; and,
- To identify the current status of desalination along with the anticipated facilities now being planned.

Staff's presentation to the Commission will also serve as the start of an initial sixty-day public comment period on the report. Copies of the report will be available at the Commission meeting, on the Commission's website at www.coastal.ca.gov, or may be requested from the address below. Comments received during this period will be evaluated for inclusion in a final report to be issued later this year. Written comments should be sent by November 7, 2003 to:

Tom Luster
California Coastal Commission
45 Fremont Street, Suite 2000 or via e-mail to: tluster@coastal.ca.gov
San Francisco, CA 94105

The report is being coordinated with several other desalination-related efforts in California, including the update of the Monterey Bay National Marine Sanctuary Management Plan, which is considering conditions to apply to desalination intakes and outfalls, and the efforts of a state task force convened by the Department of Water Resources to identify opportunities and constraints regarding the role of desalination in contributing to the state's water supply.

DRAFT

Seawater Desalination And the California Coastal Act

California Coastal Commission
August 2003

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

Thanks to many people, including –

Brad Damitz, Monterey Bay National Marine Sanctuary
Sabine Lattemann, University of Oldenburg
Holly Price, Monterey Bay National Marine Sanctuary
Members of the Monterey Bay National Marine Sanctuary Desalination Work Group
Members of the State Desalination Task Force
Members of the Coastal Commission staff

EXECUTIVE SUMMARY

There is growing interest and concern about seawater desalination along the California coast. The interest is due in part to recent technological developments that reduce the costs and energy requirements of producing desalinated water. Additionally, many water agencies and purveyors are interested in reducing their dependence on imported water supplies, and view desalination as providing a reliable and local source of water. The concerns are due primarily to the potential for desalination to create growth and adverse effects beyond the capacity of California's coastal resources.

There are currently about two dozen desalination facilities being proposed along the California coast, including some that would be the largest in the U.S. The state does not have a great deal of recent experience or expertise in evaluating the environmental impacts or the public resource issues associated with desalination proposals, and this report is meant to provide a part of the information needed to carry out those evaluations.

This report has several main purposes:

- To provide general information about the issues related to desalination along the California coast;
- To discuss Coastal Act policies that are likely to apply to various proposed desalination facilities;
- To identify information that is likely to be required during coastal development permit review for proposed facilities; and,
- To identify the current status of desalination along with the anticipated facilities now being planned.

Additionally, the report is based on several key points:

- ***It is meant to be informational only:*** The report does not create new regulations or guidelines for reviewing proposed desalination facilities. Rather, it describes desalination issues as the relate to existing Coastal Act policies, and discusses how these policies are likely to apply to a proposal. Additionally, it provides several examples of previous Coastal Commission decisions that illustrate how particular policies may apply to desalination facilities.

- ***It is based on the need to provide case-by-case review:*** Because each proposed desalination facility will have unique design and siting characteristics, Coastal Act policies will likely apply differently to each particular proposal. This report, therefore, makes no overarching recommendations in support or opposition to desalination. Some desalination proposals may be environmentally benign or may even provide environmental benefits; others may cause significant adverse impacts.

Since many of the concerns and issues involved in large-scale coastal desalination have not yet been tested in California, much of this report is written in a precautionary tone. Some of the facilities being proposed raise significant public policy and environmental issues, and the consequences of some issues, especially those related to the private consumptive use of ocean water and international trade agreements, are still emerging. It is therefore likely that the reviews of the first set of upcoming proposed facilities will require comprehensive, detailed, and specific analysis to ensure the facilities meet applicable policies and allow the state to maintain and protect its coastal resources.

The report is also being issued as part of a larger effort to determine the implications of desalination to California. Earlier this year, the Department of Water Resources convened a task force, pursuant to AB 2717, to identify the opportunities and constraints for desalination providing part of the state's water supply, and to evaluate whether the state should play a role in supporting desalination. The final version of this report will consider the work of the task force, as well as public comments received over the next sixty days, in more fully evaluating the Coastal Act policies and related issues as they apply to seawater desalination.

INITIAL FINDINGS

Among the primary findings in this report are:

- ***Coastal Act policies do not suggest overall support of, or opposition to, desalination:*** The Coastal Act allows many types of development to occur within the coastal zone, as long as it conforms to Coastal Act policies. Desalination is one of these types of development.

- ***Each proposed desalination facility will require case-by-case review:*** Because each facility has unique design, siting, and operating characteristics, different Coastal Act policies are likely to apply to each one, requiring them to be assessed case-by-case.

- ***There will likely be significant differences in applying Coastal Act policies to public or private desalination facilities:*** The Coastal Act is based on the coastal resources of California being public resources, and the consumptive use of seawater by private interests will require thorough evaluation and adequate assurances that public uses and values will be protected.

- ***The most significant direct adverse environmental impact of seawater desalination is likely to be on marine organisms:*** This impact is due primarily to entrainment and brine discharges; however, both can be mitigated through proper facility design, siting, and operations.

CHAPTER 1: INTRODUCTION AND BACKGROUND

PURPOSE OF REPORT

For years, desalination has been considered as a possible source of fresh water for areas of coastal California. The existing supply of water along parts of the coast has been one of the primary limits on the rate of growth. However, due to relatively high costs and energy requirements, desalination has provided a relatively small amount of the water supply used in coastal California compared to other sources such as imported water and groundwater or compared to measures such as water conservation. Recent changes in desalination technology have allowed costs to be reduced to levels at or near the costs of some of these other sources. Additionally, desalination is seen by some as a way to provide more reliable supplies of water and to reduce the dependence of coastal communities on water imported from inland areas. As a result, desalination is being considered a more feasible source of water in many areas of the California coast. In the summer of 2003, there were about two dozen proposals for desalination facilities being considered at various locations along the coast.

Desalination facilities proposed along California's coast will require review by the California Coastal Commission and a decision by the Commission as to whether the proposal conforms to the policies of the California Coastal Act. This report addresses many of the issues that would be considered during such a review, and is meant to serve three main purposes:

- To provide information to the interested public about some of the issues related to desalination along the California coast, especially as they relate to the Coastal Act;
- To provide information to interested parties about the kinds of information and evaluation that will likely be needed as part of the Coastal Commission's review of proposed facilities to determine whether the proposals conform to Coastal Act policies; and,
- To summarize the current status of desalination along the coast and list the known anticipated facilities now being planned.

The report also provides the following information:

- It updates the Coastal Commission's 1993 report, "Seawater Desalination in California". At the time that report was published, the state was just coming out of a period of several years of low water supplies, and there were about a dozen relatively small desalination facilities along the California coast, producing relatively expensive water for drought relief, emergency supply, or for use in areas isolated from other water sources. Since that time, the pressures on other available sources of water have continued to increase, and the economic costs of desalination have decreased substantially.

- It is being updated in association with the work of the California Department of Water Resources Desalination Task Force, which has been charged with identifying the opportunities and constraints for desalination in the state and determining what role, if any, the state should play in furthering desalination technology. The report is also built in part on the work done by a desalination work group convened by the Monterey Bay

National Marine Sanctuary as part of the Sanctuary's update of its Management Plan. While the Sanctuary contributions focused primarily on issues of concern within Sanctuary boundaries, much of the work is applicable to the entire California coastline.

- Pursuant to section 30006.5 of the Coastal Act, this report is meant to provide "sound and timely scientific recommendations to the Coastal Commission", for use in decision-making on significant issues related to coastal resources.

PRIMARY FINDINGS

The report does not make general recommendations in support of, or opposition to, desalination: California may soon include desalination as an important part of the overall state water supply. Some desalination facilities may be operated in an environmentally benign manner and may even result in environmental benefits. Others proposed facilities could be designed or located so that they would cause significant adverse effects and would not conform to applicable regulations. – Therefore –

Desalination facilities will require case-by-case review: Because each proposed facility will have a different design and location, each will also raise different issues of concern and likely be subject to a different set of Coastal Act policies. Therefore, the information provided in this report recognizes that each desalination proposal will require case-by-case review. This case-by-case approach will allow each proposal to be reviewed based on the specific characteristics of the proposed facility and the particular coastal resources of concern at specific sites. Although each facility will undergo case-by-case review and a location-specific evaluation, this report is meant to provide sufficient general information about the types of review and the level of detail likely to be required to complete Coastal Commission review.

There will likely be significant differences in applying Coastal Act policies to public or private desalination facilities: The Coastal Act is based largely on coastal resources being public resources. Private consumptive use of these resources raises will require a different type of review than public use.

The most significant direct adverse environmental impact of seawater desalination is likely to be on marine organisms: Seawater desalination facilities using intakes drawing water from the open ocean will entrain and kill many small marine organisms, such as plankton, larvae, and fish eggs, and in some cases, this impact could be significant. However, there are several alternative designs and mitigation measures that will be considered in project review that could completely avoid or substantially reduce this impact.

REPORT ORGANIZATION

Chapter 1 of this report provides a brief introduction, a description of existing and proposed desalination facilities along the California coast, and some of the current local, state, and federal initiatives on desalination. **Chapter 2** follows with a description of the main methods used in desalination and a discussion of desalination costs and energy requirements. **Chapter 3** discusses the primary public resource issues related to reviewing proposals for conformity to the Coastal Act, including the Public Trust Doctrine, issues of public or private ownership,

international trade, and several specific Coastal Act policies. **Chapter 4** discusses some environmental effects that desalination may have on various coastal resources, in particular those associated with marine biology and water quality. **Chapter 5** provides a brief description of some other regulatory issues and the local, state, or federal agencies likely to be involved in desalination review. **Appendix A** includes a glossary of desalination-related terms.

1.1 EXISTING AND PROPOSED DESALINATION FACILITIES ALONG THE CALIFORNIA COAST

There are currently about a dozen existing desalination facilities along the California coast (see Table 1) and at about two dozen proposed facilities being considered (see Table 2). Comparing the two tables gives a sense of the current high level of interest in desalination along the coast and the scale of the changes being considered. Existing coastal desalination facilities are relatively small, and in total, can produce up to a maximum of about 3100 acre-feet per year. The total output of all the currently proposed coastal facilities, including some that would be the largest in the country, would be about 220,000 acre-feet per year, which represents a 70-fold increase in production.

Table 1: Existing Desalination Facilities Along the California Coast

Operator/Location/Purpose/ Public or Private:	**Purpose/ Public or Private:**	**Maximum Capacity:**	**Status:**
Chevron/ Gaviota	- Industrial processing - Private	410,000 gpd/ 460 AF/yr.	Active
City of Morro Bay	- Municipal/domestic - Public	600,000 gpd/ 672 AF/yr.	Intermittent use
City of Santa Barbara	- Municipal/domestic - Public	N/A	Inactive
Duke Energy/ Morro Bay Power Plant	- Industrial processing - Private	430,000 gpd/ 482 AF/yr.	Not known
Duke Energy/ Moss Landing Power Plant	- Industrial processing - Private	480,000 gpd/ 537 AF/yr.	Active
Marina Coast Water District	- Municipal/domestic - Public	45,000 gpd/ 50 AF/yr.	Active
Monterey Bay Aquarium	- Aquarium visitor use - Non-profit	40,000 gpd/ 45 AF/yr.	Active
PG&E/ Diablo Canyon	- Industrial processing - Private	576,000 gpd/ 645 AF/yr.	Not known
State Parks & Recreation/ San Simeon	- Visitor center use - Government	10,000 gpd/ 11 AF/yr.	Inactive
Santa Catalina Island	- Municipal/domestic - Private	132,000 gpd/ 148 AF/yr.	Not known
U.S. Navy/ Nicholas Island	- Municipal/domestic - Government	24,000 gpd/ 27 AF/yr.	Not known
Various offshore oil & gas platforms	- Platform uses - Private	2,000–30,000 gpd/ 2–33 AF/yr.	Active
Total Production:	***~ 2.75 million gallons per day /3100 acre-feet per year***		

Note: *gpd = gallons per day, and AF/yr. = acre-feet per year. There are approximately 326,000 gallons in an acre-foot. Typically, a household will use one to two acre-feet per year.*

Table 2: Proposed Desalination Facilities Along the California Coast

Operator/ Location:	**Purpose, and public or private:**	**Maximum Capacity:**	**Status:**
Cambria Community Services District	- Municipal/ domestic - Public	430,000 gpd/ 481 AF/yr.	Planning
Cannery Row Marketplace/ Monterey	- Development - Private	5,000 gpd/ 6 AF/yr.	EIR completed
Carmel Area Wastewater District	- Municipal/ domestic - Public	Not known	Not known
City of San Buenaventura	- Municipal/ domestic - Public	Not known	Not known
City of Sand City	- Municipal/ domestic - Public	27,000 gpd/ 30 AF/yr.	Planning
City of Santa Cruz	- Municipal/ domestic - Public	2.5 million gpd/ 2800 AF/yr.	Planning
East-West Ranch/ Cambria	- Development - Private	Not known	Withdrawn
Fort Ord State Park/ Monterey	- Municipal/ domestic - Public	Not known	Planning
Long Beach	- Research - Public	300,000 gpd/ 335 AF/yr.	Design phase
Long Beach	- Municipal/ domestic - Public	10 million gpd/ 11,000 AF/yr.	Planning
Los Angeles Dept. of Water and Power	- Municipal/ domestic - Public	10 million gpd/ 11,000 AF/yr.	Planning
Monterey Bay Shores	- Development - Private	20,000 gpd/ 22 AF/yr.	Not known
Monterey Peninsula Water Mgmt. District / Sand City	- Municipal/domestic - Public	9 million gpd/ 10,000 AF/yr.	Planning
Municipal Water District of Orange County / Dana Point	- Municipal/domestic - Public	27 million gpd/ 30,000 AF/yr.	Planning
Poseidon Resources / Huntington Beach	- Various - Private	50 million gpd/ 55,000 AF/yr.	Draft EIR completed
San Diego County Water Authority & Poseidon Resources /Carlsbad	- Municipal/domestic - Public/private	50 million gpd/ 56,000 AF/yr.	Planning
U.S. Navy / San Diego	- Municipal/domestic - Government	700,000 gpd/ 780 AF/yr.	Not known
West Basin Municipal Water District	- Municipal/domestic - Public	20 million gpd, 22,000 AF/yr.	Planning
Total Production:	***~ 187 million gallons per day / 220,000 AF/yr.***		

1.2 OTHER STATE, FEDERAL, AND LOCAL DESALINATION PROGRAMS

There are a number of efforts currently underway in California to study, promote, or anticipate the need for additional water supplies using desalination or other methods, including:

STATE

California Department of Water Resources:

- Update of the California Water Plan for 2003: The Plan will include desalination as one of several water sources that will allow diversification of the state's water supply.
- Convening a Desalination Task Force (per Assembly Bill 2717): This task force first met in Spring 2003 and is scheduled to continue through at least October 2003. It is charged with identifying the opportunities and constraints for the use of desalination technology in providing some of the state's water supply, and to examine whether the state should play a role in furthering the use of desalination. The products of this task force will be used in part in preparing the final version of this Draft Seawater Desalination Report.

California Energy Commission:

- Review of entrainment studies: The CEC is compiling information about existing entrainment studies that have been used to review the effects of coastal power plants. These studies are meant in part to determine the recency, adequacy, and applicability of these studies to current environmental conditions near the plants.
- Energy demand: Energy Commission staff is compiling data to help determine how the energy demand of proposed desalination facilities will affect the state's power grid.

FEDERAL

Bureau of Reclamation: The Bureau is working with the City of Long Beach Water Department to develop a nanofiltration desalination technology which is anticipated to be much more energy-efficient than other types of reverse-osmosis membrane technology. The two agencies are developing a pilot project to test various techniques and types of equipment. The project would be located at the Haynes Generating Station in Long Beach.

Monterey Bay National Marine Sanctuary: The Sanctuary is updating its Management Plan and will consider including recommendations about how desalination facilities should be sited or operated within Sanctuary boundaries. The recommendations were developed by a desalination workgroup representing a number of interests and stakeholders in the Monterey Bay area, and will be evaluated by both the Sanctuary Advisory Group and the public during review of the Draft Management Plan during the summer and fall of 2003. The workgroup's recommendations include the following:

- Develop a regional planning program for desalination.
- Develop facility siting guidelines, including identifying preferred conditions and habitats, areas that should be avoided, etc.
- Define standards for entrainment and impingement caused by desalination facilities and limits for brine discharges to Sanctuary waters.

- Determine which water quality models are suitable for determining discharge plumes for desalination outfalls.
- Identify the minimum required information for permit applications.
- Develop a regional monitoring program to determine cumulative impacts of multiple desalination facilities.
- Develop an education and outreach program for desalination issues.
- Track and evaluate emerging desalination activity and technology and outside the Sanctuary.

The Sanctuary's final recommendations, when adopted, may assist the public and staff from other agencies staff in evaluating the adequacy of environmental review for proposed facilities in other areas along the coast.

LOCAL AND REGIONAL

A number of local or regional water districts are also considering desalination programs to provide a portion of their water supplies. Although desalination is more expensive than existing supplies, there is a growing interest by water supply agencies to diversify their water sources and to decrease their reliance on imported water. Major efforts include:

- ***Metropolitan Water District (MWD) of Southern California:*** MWD is seeking proposals to build and operate coastal desalination facilities within its Southern California service area. To further this goal, MWD has offered to subsidize desalination production at the rate of $250 per acre-foot for up to 25 years. At this time, five of the proposals shown on Table 2 are being considered as part of this program:
  - Long Beach
  - Los Angeles Department of Water and Power
  - Municipal Water District of Orange County
  - San Diego County Water Authority/Poseidon Resources
  - West Basin Municipal Water District

  The purposes of this program include reducing Southern California's dependence on imported water supplies and enhancing the portfolio of supplies available to the area. It is further meant to provide an incentive to develop desalination as an additional water source in Southern California.

- ***San Diego County Water Authority(SDCWA):*** In its 2000 Urban Water Management Plan, SDCWA identified seawater desalination as an option for providing up to 25 million gallons per day of the local water supply by 2020.

CHAPTER 2: METHODS AND TECHNICAL ASPECTS OF DESALINATION

Desalination is any of several methods that remove dissolved salts and other chemicals from seawater, brackish water, or treated wastewater so that the water can be used for a wide range of purposes. Desalination is most well-known as a technique for treating seawater to provide drinking water, but it is also used to produce water for various industrial processes and can be used to treat sources of water other than seawater, including brackish groundwater, recycled or reclaimed wastewater, agricultural runoff water, and others.

Generally, a desalination facility draws in brackish or salt water (the feedwater), and separates it into two separate streams – desalted water with a minimal concentration of dissolved salts and minerals (the product water), and a liquid containing the residual dissolved solids (the brine effluent). Depending on the process used, every 100 gallons of seawater can produce 15 to 50 gallons of potable water, with the remainder being brine containing dissolved solids.

2.1 DESALINATION METHODS AND PROCESSES

There are a number of desalination methods, including reverse osmosis, distillation, electrodialysis, and vacuum freezing. Reverse osmosis and distillation represent the predominant technologies currently being used around the world, and those are the two methods briefly described below. Most of the facilities being proposed along the California coast would use reverse osmosis methods.

Distillation: This process requires the intake water to be heated to produce a vapor, which is condensed to produce water with a low concentration of dissolved salt and other minerals, essentially mimicking the hydrological cycle that occurs in nature. The most common methods of distillation include multistage flash (MSF), multiple effect distillation (MED), and vapor compression.

Reverse Osmosis: In reverse osmosis, feedwater is pumped at high pressure through permeable membranes, which separate salt and other minerals from the water. The pores in the membrane are large enough to allow water molecules to pass through, yet are too small to allow the passage of salt and other minerals. Reverse osmosis facilities generally involves four separate processes: pretreatment, pressurization, membrane separation, and post-treatment stabilization. Pretreatment is used to remove suspended particles from the source water to keep the membrane surfaces clean and to treat the water to prevent growth of microbes on the membranes. The feedwater is then pressurized to about 1000 psi, a process that results in most of the energy demand for the reverse osmosis desalination method. The pressurized feedwater is then forced through the reverse osmosis membrane. Product water quality is sometimes improved by passing the water through a second set membranes. Once the feed water is separated into two streams, the product water is treated to meet drinking water requirements, and then to the water distribution or storage system.

COMPARISON OF DISTILLATION AND REVERSE OSMOSIS

Distillation: The most significant disadvantage of distillation is that it is extremely energy intensive, which typically limits its use to areas where energy costs are not as critical an issue. These facilities have most commonly been used in the Middle East. Distillation plants generally require less pretreatment of feedwater than is necessary in reverse osmosis, and they can generally use feedwater of lower quality than reverse osmosis plants facilities. Distillation plants also do not need to shut down production for cleaning or replacement of equipment as often as reverse osmosis plants, and they do not generate waste from backwash of pretreatment filters. Scaling and corrosion of distillation plants are the major maintenance concerns, due to the exposure of the unprotected evaporator components to very corrosive feedwater.

Reverse osmosis: The major advantage of reverse osmosis over distillation is that it is less energy intensive. Recent developments including more efficient membranes and energy recovery devices have dramatically reduced the operating costs of reverse osmosis over the past decade. Other advantages of reverse osmosis plants over distillation include:

- lower thermal impacts since the feedwater does not have to be heated;
- fewer corrosion problems;
- have higher recovery rates, up to about 50% for seawater;
- less surface area than distillation plants for the same amount of water production.

Because reverse osmosis plants are more sensitive to poor water quality, it may be necessary to shut down plants which draw their feedwater from the open ocean during severe storms, which can increase the amount of suspended particulates in the feedwater. Other disadvantages of reverse osmosis include the need to shut down the plant more often for routine cleaning and maintenance, and the risk of bacterial contamination of the membranes.

Reverse osmosis also involves more extensive pretreatment using biocides, coagulants, and other compounds to reduce membrane fouling. These facilities also require frequent cleaning of the filters and membranes using other chemical compounds and backwashing. Finally, they produce liquid wastes that may contain a range of constituents, including high salt concentrations, chemicals used during treatment and cleaning processes, toxic metals from facility materials, and others.

2.2 ECONOMICS OF DESALINATION

Main Points:

- ***It is difficult to determine the full range of costs and benefits of any water supply, including desalination.***
- ***One advantage to coastal desalination facilities is that, from an economic standpoint, seawater has been considered free.***
- ***The most expensive part of the desalination process is energy costs.***
- ***Desalination is still more expensive than other water sources, but some water providers are interested in desalination serving as a local and more reliable alternative to imported water supplies.***

INTRODUCTION

It is difficult to determine the full economic cost of any source of water. Providing water supplies generally require both relatively direct and easily determined economic outlays – such as the capital cost to construct treatment plants and pipelines, the costs of operating and maintaining a water supply system, and the cost of electricity needed to pump water from one location to another – as well as indirect and non-monetary costs that are usually more difficult to determine – such as the environmental costs associated with lost streamflow or reduced watershed health caused by exporting water out of an area (e.g., fewer fish, smaller wetlands), societal costs (e.g., fewer recreational opportunities, decreased tourism), the costs of centralized infrastructure instead of dispersed systems, and others. These indirect costs may result in more significant economic, social, political, and environmental effects than the direct economic costs.

Adding to the difficulty of determining the overall costs of a water supply is that these costs are countered by indirect or non-economic benefits – for instance, moving water from a stream to a distant reservoir may result in the loss of recreational opportunities in one location that are offset by increased recreational opportunities in another. Moving water from an area with a smaller population and lower economic demand into an area with a larger population and larger existing economic infrastructure may create more extensive economic benefits related to increased development. Another difficulty in determining costs is that these indirect economic considerations may or may not be evaluated as part of any particular water system depending on the level of public oversight, public interest and review, the perceived values of the affected resources, and other factors.

WHAT INFLUENCES DESALINATION COSTS?

Given the caveats above, some of the primary variables that determine costs for desalinated water are described below, along with some general comparisons between the costs of desalination and the costs of other water supplies. Many of these costs are also common to producing, storing, or transporting water from other sources.

- ***Water source:*** From an economic standpoint, one of the primary benefits of seawater as a source of potable water is that it generally has a direct monetary price of zero. Seawater is seen as inexhaustible and noninterruptible, and therefore not subject to price variations due to scarcity or supply and demand. If a proposed desalination facility is co-located with a

facility using an existing seawater supply, such as a power plant that uses ocean water for cooling, there may additional costs savings by not having to site, design, and construct new intake and outfall systems needed to use seawater as the source water. [Note: the advantages and disadvantages of co-location are discussed in more detail in Chapter 4.2.]

Other sources of water for desalination, such as reclaimed or recycled water, may have to be purchased from suppliers and may be subject to supply variability. However, these sources are often easier and less expensive to treat to drinking water standards, because they generally have lower concentrations of salts, minerals, and solids. In general, the lower the concentrations of solids, the less expensive it is to desalt the water.

- ***Energy:*** Energy requirements are the single largest direct cost in producing desalinated water. Advances in desalination technology over the last ten years have significantly reduced the amount of energy needed to produce a given amount of water; however, energy continues to represent about half the costs in desalination production. Besides the energy costs involved in producing the water, desalination also requires energy to transport water to its end users. This is a cost common to nearly all water sources. Water is a relatively heavy commodity and energy costs to pump water uphill or to move it long distances can be the single largest expense for many water systems. Because desalination facilities located along the coast will generally be located at the lowest elevation of a water service area, they could have significant "lifting" and distribution costs to get the water to the end users.

- ***Desalination method:*** Of the two primary desalination methods, distillation generally has higher energy costs than reverse osmosis because of the need to heat the source water. The cost differential between the two methods can be reduced somewhat if the source water is pre-heated or if it derives waste heat from another process, such as discharged cooling water from a coastal power plant, which may be 20^{o} C. above ambient ocean water temperature.

- ***Scale and capacity of facility:*** There may be economies of scale with certain types of desalination facilities, although this is likely to depend on the particular characteristics and location of a given facility.

- ***Infrastructure:*** A desalination facility must be able to either connect to an existing distribution system or construct a new distribution system to get water to the end users. This cost will vary by location, size of the service area, and other factors.

- ***Maintenance and Cleaning:*** Each desalination facility requires some level of anti-fouling treatment and regular maintenance and cleaning, which will vary based on the desalination method used, the type of materials used, and other factors. Recent developments in membrane technology have extended the expected lifespan of many membranes, filters, and associated materials; however, several of these improvements have not been thoroughly tested in a production environment. Additionally, once treated water is in the distribution system, it must be kept clean until it reaches the end users, so there are ongoing costs associated with maintenance and cleaning the water supply system.

- ***Full-time or part-time operation:*** Facilities that operate part time or to provide back-up supply are likely to have higher costs per acre-foot of produced water since the capital and maintenance costs must be paid even when the facility is not producing.

Other variables may include easily-determined costs and benefits such as sales revenue or financial incentives such as subsidies and grants, as well as less easily-determined considerations such as the value to a water purveyor or to end-users of having a reliable supply, increased control over future supplies, and the avoided costs of treatment, storage, and conveyance from other sources (from 2000 Urban Water Management Plan, San Diego County Water Authority).

REDUCED COST DIFFERENCE BETWEEN DESALINATION AND OTHER SOURCES

A significant economic change during the last decade is the reduced difference in cost between desalinated water and other water sources. In its 1993 report, the Coastal Commission found that desalination provided water at a cost of between $1000 and $4000 per acre-foot (including operation and maintenance costs, along with capital costs amortized over an assumed plant life of 20 to 30 years). While there are currently no large-scale coastal desalination facilities operating in Southern California and therefore no actual costs to provide an accurate comparison, estimated costs from several facilities being proposed along the California coast (see Table 3) range from $711 per acre-foot to $1171, which represent a substantial decrease from 1993 cost estimates.

Concurrently, the costs of other existing water sources have increased significantly during the same period. For example, in 1991, the Metropolitan Water District (MWD) of Southern California paid approximately $27 per acre-foot for water delivered from the Colorado River and $195 per acre-foot for water from the California Water Project. The MWD now pays an average of $460 per acre-foot of delivered water. As a result of the cost increase for imported water and the cost decrease for desalination, the difference between the costs of the two sources has declined from up to 3000 percent in 1993 to roughly 50 to 100 percent today.

Table 3: Anticipated costs of several Southern California Desalination Proposals

Facility:	***Capacity (in million gallons per day):***	***Capital Cost (in millions):***	***Cost of Production (per acre-foot):***
Los Angeles Department of Water and Power	12	$70	$1033
Long Beach Water District	9	$62-92	$711-1171
Orange County Municipal Water District	25	$114-140	$860-1007
San Diego County Water Authority	50	$272	$909
West Basin Municipal Water District	20	$130	$904
The above figures are from Shahid Chaudhry, California Energy Commission – Unit Cost of Desalination presentation to Desalination Task Force, July 30, 2003.			

HOW ARE ECONOMIC COSTS INCORPORATED INTO COASTAL ACT REVIEW?

Review under the Coastal Act requires evaluating the adverse environmental effects of proposed projects, identifying measures to avoid or minimize those effects, and determining which of those measures are feasible. "Feasibility" is defined in section 30108 of the Coastal Act as "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors". Cost, therefore, is an important consideration in determining the feasibility of a project, as well as determining which alternatives and mitigation measures are to be included with a coastal development permit. Chapter 3.2.3 of this report discusses "feasibility" in greater detail.

Example: Estimated Costs of Desalinated Water In Tampa Bay, Florida

A recent study by the San Diego County Water Authority reviewed some of the economic considerations of a 25 mgd desalination facility being built in Tampa Bay, Florida. It was estimated that water produced from that facility will cost between $560 and $680 per acre-foot, which is significantly lower than the estimates from other recent desalination facilities, due in part to several economically advantageous aspects of the proposal:

- The source water in Tampa Bay has lower salinity than ocean water (approximately 26,000 mg/L TDS vs. 35,000 mg/L in seawater) and therefore requires less treatment.
- Power costs are just under $0.04 per kilowatt-hour.
- The facility would use an existing cooling water intake and outfall from an adjacent power plant.
- The facility includes modifications to comply with some existing permits.
- It includes economies of scale due to its relatively high capacity of 25 mgd. (from SDCWA Urban Water Management Plan, 2000).

The plant has been in operation since March 2003, but has been shut down for much of that time due to unanticipated maintenance requirements.

2.3 ENERGY USE IN DESALINATION

Main Point:

- ***Recent technological changes have significantly reduced desalination energy needs, although, energy is still the single largest cost in producing desalinated water.***

Energy requirements for desalination plants are relatively high compared to the energy required to provide water from other sources; however, the trend in cost reductions over the last decade described in the previous section has also occurred with reductions in the energy use needed to produce desalted water. The energy required for desalination varies depending on a number of factors, including:

- ***Type of desalination method used:*** The energy requirements for reverse osmosis are generally less than those for distillation.

- ***Characteristics of source water:*** Desalination of ocean water (at 30 parts per thousand salinity) generally requires more energy than desalination of brackish water (at 5 to 30 parts per thousand salinity) or of most groundwater (variable salinity). Additionally, cooler water generally requires more energy to desalinate than warmer water.

- ***Scale and efficiency of the desalination facility:*** Energy requirements will vary by type of facility, manufacturer, and materials used. However, many desalination facilities are composed of discrete units that are capable of producing a certain amount of water, and the scale of a facility is largely a function of how many production units are linked together.

- ***Source of energy:*** This will vary based on using natural gas, electricity, cogeneration processes, or other sources.

- ***Desired quality of end product:*** Not all desalinated water is intended to be used as drinking water, so energy requirements will vary depending on whether the water will be applied to uses needing higher- or lower-quality water, such as manufacturing, irrigation, or agriculture.

Desalination also has energy requirements common to other water supply systems, such as the transmission costs (e.g., pumping and storage) involved in getting the water to end users.

CHAPTER 3: PUBLIC RESOURCE POLICIES OF THE COASTAL ACT RELATED TO DESALINATION

This chapter discusses several of the Coastal Act's more broadly applicable policies and how they might apply to coastal desalination facilities. Environmental policies related to specific coastal resources, primarily marine biology and water quality, are discussed in Chapter 4.

This chapter contains two main sections. The first describes several elements that serve as the basis for much of the Coastal Act, including the Public Trust Doctrine, which is an underlying legal construct of the Coastal Act, and the role of coastal resources as part of the public "commons", including a discussion of the potential shift of seawater from a "commons" resource to a commodity. These discussions are followed with a discussion of how some Coastal Act policies may apply differently to public and private desalination proposals. All of these sections address an underlying principle of the Coastal Act – that coastal resources in general, and ocean water, in particular, are public resources and values that must be protected for the benefit of current and future generations. These sections are followed by a discussion of emerging issues relating to the possible affect of international trade agreements on the ability of local communities and the Commission to implement coastal environmental resource protection policies in connection with regulatory review of desalination projects.

The second main section describes specific Coastal Act policies that recognize coastal resources as public resources, and how these policies are likely to be evaluated during review of proposed desalination facilities. The Coastal Act policies in this section include those related to growth-inducement, "coastal-dependency", feasibility, and priority uses.

3.1 BACKGROUND AND STATUS OF COASTAL RESOURCES AS PUBLIC RESOURCES

3.1.1 The Public Trust Doctrine

Main Points:

- ***Ocean water is a public trust resource to be protected for public use.***
- ***Any approved uses of ocean water must ensure protection of public rights, interests and values in the use of such waters for navigation, fishing, recreation, and eco-system preservation pursuant to the Public Trust Doctrine and Coastal Act policies.***

The Public Trust Doctrine is a long-held legal construct of American property law and predates the origins of the U.S. and many other Western countries where it applies, by centuries. The doctrine as applied in the U.S. is an expanded version of the form contained in English Common Law dating from the era of the Magna Carta in the 13th Century, which is, in turn, based on the Justinian Code of the Roman Empire.

The essence of the Public Trust Doctrine is that the public has the right to use and enjoy lands underlying navigable waters. Its most common uses have been to ensure the public has access to navigable waters and tidelands for navigation, commerce, and fishing. The flexibility inherent in the doctrine has resulted in each state applying it differently. In California, the doctrine is invoked in portions of the state Constitution[1]. California courts have recognized it as being sufficiently flexible to encompass changing public needs, and over time have determined the doctrine applies not only to the land underlying the water but also to the water itself[2], and applies not only to navigation and commerce but also to water quality[3]. Courts in this state have also recognized that the doctrine allows the public to use navigable waters for "…boating, swimming, fishing, hunting, and all recreational purposes"[4], "preservation"[5], and other "ecological and aesthetic values"[6]. While private uses are allowed, they are generally limited to those that would not harm public trust values, including the uses identified above.

Review of proposed coastal desalination facilities using seawater from the open ocean, bays, or estuaries must address the question whether the proposal is consistent with public trust values. Evaluation of a proposal for consistency with public trust interests may be incorporated into other aspects of the review pursuant to the Coastal Act. For example, the review of a proposed facility's impact on marine organisms may also be used to determine whether the proposal adequately promotes the "ecological and aesthetic values" that are part of the Public Trust Doctrine.

---

[1] California Constitution, Article 1, Section 25: "The people shall have the right to fish upon and from the public lands of the State and in the waters thereof, excepting upon lands set aside for fish hatcheries, and no land owned by the State shall ever be sold or transferred without reserving in the people the absolute right to fish thereupon; and no law shall ever be passed making it a crime for the people to enter upon the public lands within this State for the purpose of fishing in any water containing fish that have been planted therein by the State; provided, that the legislature may by statute, provide for the season when and the conditions under which the different species of fish may be taken."

[2] *National Audubon Society v. Superior Court*, (1983) 33 Cal.3d 419

[3] *People v. Gold Run Ditch and Mining Co.* (1884) 66 Cal. 138

[4] *People v. Mack*, 19 Cal. App. 3d 1040, 1045, 97 Cal. Rptr. 448 (1971)

[5] *Marks v. Whitney*, 6 Cal.3d 251, 259, 491 p.2d 374, 98 Cal. Rptr. 790 (1971) – "[O]ne of the most important public uses of the tidelands… is the preservation of these lands in their natural state…"

[6] *National Audubon Society v. Superior Ct.*, 33 Cal.3d 419, 435, 658 p.2d 709, 189 Cal. Rptr. 49 (1983) – "The principle values the plaintiff seeks to protect, however, are recreational and ecological – the scenic views of the lake and its shore, the purity of the air, and the use of the lake for the nesting and feeding by birds. Under *Marks v. Whitney*, 6 Cal. 3d 251 [491 P.2d 374, 98 Cal. Rptr. 790] (1971), it is clear that protection of these things is among the purposes of the public trust." Also *City of Berkeley v. Superior Court*, 26 Cal.3d 515, 521, 606 P.2d 362, 162 Cal. Rptr. 327 (1980) – "Although early cases expressed the scope of the public's rights in tidelands as encompassing navigation, commerce and fishing, the permissible range of public uses is far broader, including the right to …preserve the tidelands in their natural state as ecological units for scientific study."

3.1.2 Seawater as a Public Resource

Main Points:

- ***Privatization and commodification of public trust resources would represent a major shift in public policy.***
- ***Coastal Act policies have been applied recognizing the difference between public and private proposals, especially as they relate to public services.***

A fundamental Coastal Act principle is that coastal resources are imbued with a public interest and value that must be vigorously protected for the benefit of current and future generations. Unlike many coastal resources that are privately owned, ocean waters constitute a public trust resource held in common for public use and enjoyment. This principle is codified in numerous federal and state laws and regulations, including the Coastal Act.

Ocean waters serve a number of vital environmental, social, and economic functions. They are part of the shared public "commons" available to all serving as habitat for a great diversity of life, a source of food and livelihood, and meeting needs for transportation, commerce, recreation, and other important societal amenities. For the most part, these uses are non-consumptive and sustainable, in that using ocean waters for one of these purposes does not necessarily impair their ability to be used for others.

Using seawater as a source of potable water converts ocean waters from being subject to mostly non-consumptive uses to a consumptive use. While the scale of ocean water consumption through desalination is extremely small compared to the overall size of the resource, cumulative impacts could be significant and the economic dynamics and considerations involved in using a resource consumptively are significantly different from those for a non-consumptive use. A significant difference is that seawater is transformed in the process from a public trust resource held in common for public use to that of a commodity that is taken out of the ocean for consumption and sale.[7] This "commodification" of a public trust resource will be accompanied by significant implications and shifts in how ocean water is viewed, managed, and used, in addition to its conversion from a use as a good or service formerly subject to many non-market social rules into one that is primarily subject to market economic rules (Gleick, 2002).

This shift is not unique – many other public goods or resources have become commodities, including fresh water (through appropriative water rights, water marketing, interbasin transfers, etc.), clean air (through emissions trading), and public land (through grazing permits, timber harvests, mineral extraction, etc.). Each of these shifts has been accompanied by changes in the underlying perceptions of a given resource relative to public and private rights, interests, values and responsibilities, as well as changes in both anticipated and unanticipated costs and benefits resulting from the manner in which they are used.

[7] Commodity: "1. Something useful that can be turned to commercial or other advantage…; 2. An article of trade or commerce, especially an agricultural or mining product that can be processed and resold." From The American Heritage® Dictionary of the English Language, Fourth Edition.

In addition, these elements of the commons – fresh water, clean air, public land – involve resources initially thought of as limitless, renewable, or sustainable, at least at their historic levels of use. However, with increasing pressures at local or regional scales, these resources shift from being used at renewable levels to being used at unsustainable levels and in ways that reduce their availability to the public at large. Increased consumptive uses may therefore create localized losses of what were previously basic social goods, or may further increase pressure to emphasize the commodity value over their "commons" value. For example, trading emissions credits between air basins may result in an overall air quality improvement, but may cause one local population to suffer the loss of a common good (healthful air quality) due to improvements gained by another local population. Similarly, a large-scale interbasin transfer of fresh water to a heavily-populated area may create shortages of a previously "common" good in the source area where economic pressures or influences are not as great as in the areas to which the water is being transferred. While desalination of ocean waters does not raise exactly the same concerns as interbasin transfers of surface or subsurface freshwater, there are parallels. For example, a seaside community may be asked to absorb impacts from the installation and operation of a desalination facility while the produced fresh water is actually intended for use in another area of the state. This is apparently the situation relative to a proposal for a desalination facility pending before the City of Huntington Beach (the produced water is not intended for local use).

Currently, seawater is generally considered a limitless or at least a renewable resource, just as the other parts of the commons have been thought of in the past. And like those other elements, despite the size of the overall resource, the potential cumulative impact of consumptive use of seawater can cause impairment at the local or regional level, resulting in effects such as beach closures, species decline, reduction in bio-diversity, decline in water quality, or other adverse effects on coastal ecosystems.

One difference between the proposed use of seawater for desalination and the other examples above is that the shift from public trust or common good resource to that of a privatized, marketable commodity has not yet happened in California. This fact offers the opportunity for a timely assessment and deliberative public discussion of the relative merits and the potential comparative costs and benefits of allowing, or not, a shift to a privatized appropriation of a public trust resource. A timely public policy discussion and evaluation on this subject can avoid or ameliorate some of the adverse consequences stemming from the commodification of other natural resources (e.g., fresh water, air emissions, use of public lands).

3.1.3 Considerations of "public" or "private" ownership of water services

The status and meaning of "public" and "private" in the water services context exist on a continuum. There are many variations of institutional arrangements involving varying degrees of complexity related to financing, capitalization, production, maintenance, management, marketing, pricing and distribution of water for residential, commercial, industrial, agricultural, recreational and environmental use. Because water has multiple uses and benefits for human and natural communities of life, and because competition for a limited supply of freshwater by a high consuming and growing population is intense, desalination is becoming a more attractive, technologically and economically feasible alternative. Water provision has traditionally been a public service provided by public agencies at rates reflecting costs of capitalization and

operation, and subject to other aspects common to public entities, such as decision-making by elected or appointed officials, public notice, comment, and oversight, and other similar measures. Recently, provision of water, or "water services", are being seen as a potentially lucrative investment opportunity by domestic and multinational businesses seeking to make inroads into the public service sector as profit-making ventures. Public agencies faced with declining revenues and competition among demands for public services as a result, in large measure, of population growth and development pressures are increasingly considering private sector offers to provide "better and cheaper" water services. With the current interest in "deregulation", "privatization", and "running government like a business", there is a potential for commodification and privatization of ocean waters that, from the served community's perspective, may prove to be environmentally, socially and economically ill advised.

Primary Coastal Act concerns raised in connection with privatized public serving water systems relying on desalination revolve around the possible direct and indirect long-term adverse impacts on the integrity and vitality of coastal resources including increased pressure for new coastal development, proliferation of facilities, impairment of quality and affordable public services, public safety, entrainment of marine organisms, disincentives for water conservation and reclamation programs, and water quality. Obviously, the policy implications of allowing public trust resources (ocean waters) to be expropriated by the private sector as a commodity to be marketed for profit are far reaching.

Until recently, public water supplies in California have most commonly been provided by some type of public agency, municipal water district, or mutual water company, with a smaller number provided by investor-owned utilities[8]. Recent trends towards utility deregulation and interest by some government entities in privatizing public services are creating opportunities for private investors to take on some risks and responsibilities of providing water to the public in exchange for some level of compensation and profit. Additionally, water and water services are being seen in some sectors as a commodity rather than as a public trust resource, public good or public agency responsibility. As a privatized commodity, water and water services would be developed, managed, financed, marketed and delivered as a for-profit product subject to marketplace forces and practices. In a time when public entities face growing budget constraints, they may be less able or willing to make the significant infrastructure improvements to maintain or improve their services, and may choose to turn over all or some of their water supply service responsibilities to private, for-profit entities. Conversely, public entities may choose to take on some characteristics of private entities in the way they market their water supplies or expand the area in which they provide water through various forms of public-private partnerships[9].

---

[8] A public agency or municipal water district is meant to operate on behalf of the public that it serves. It is generally managed by a board that is either publicly-elected or appointed by elected officials. A mutual water company is generally a not-for-profit private company whose shareholders are the local property owners that use the water supply provided by the company. A private, or for profit company is organized as an investment venture to generate profit for its owners or shareholders, who may or may not be local users of the water supply.

The Department of Water Resources reports that in 1994-96, of the 2850 water agencies in California, 195 (or about 7%) were private investor-owned facilities (Source: California Water Plan Update: Bulletin 160-98).

[9] Rates established by the state Public Utilities Commission for water sales do not allow public agencies to profit from their water sales, but allow private entities a regulated amount of profit based on elements such as delivery costs, characteristics of the service area, and other considerations.

Privatized public serving water systems raise questions and concerns some of which may not be directly relevant for Coastal Act implementation purposes but which are nevertheless important to inform policy decision-making relative to allowing private business to take public trust resources (ocean water) for profit-making purposes. These include the following:

- Should public service sector responsibilities, such as community-serving water systems, be turned over to for-profit multinational corporations as a matter of public policy?
- Should access to clean water to meet human needs be treated as a right and not as a commodity that can be traded for profit?
- Should seawater specifically, as a public trust resource, be allowed to be expropriated by private business for profit?
- What are the implications of shifting the control and management from public entities to private? Multi-national corporations are at the forefront of the drive to privatize public-serving water systems around the country and in the world. The primary purpose of these entities, and their institutional nature, is to maximize profits for their shareholders and not necessarily to do what is in the best interest of the community or the environment. It is the responsibility of corporate directors and officers to maximize return on investment, which invariably affects the way business is conducted, and decisions are made that impact consumers, the community, and the environment. Accordingly, if corporations are allowed to own, operate and profit from water services, pressure will likely be brought to bear on ways to increase profits through means such as expansion of service area, rate increases and higher consumption. When monetary profit is the primary motive underlying the ownership and provision of water services, it is not unreasonable to expect that water conservation, water reclamation, water quality, minimization of growth-inducing effects, and safeguarding community serving water systems against hostile action will be compromised. Experience also suggests that user rates, quality of customer service, infrastructure maintenance and upgrades, system reliability and water pressure may well suffer. Unlike public agencies not in pursuit of private financial gains, privatized systems can reasonably be expected to provide only those environmental protections and other system safeguards that government regulations require or that marketing and tax write down incentives offer as benefits.
- Do public safety concerns relating to possible security concerns, including terrorist threats, to community-serving water systems warrant limiting desalination facilities to those that are publicly owned and operated? Given the importance of community water systems it is necessary and appropriate to expect the owner-operator to take all necessary and appropriate steps to ensure public safety by protecting the integrity of the system against hostile action (disruption or contamination of water supply). Public agencies must do so as a matter of fundamental agency responsibility and duty notwithstanding the costs involved. Privately owned and operated for-profit systems are not driven by similar considerations. Can private entities that are in the business of providing public water services for profit be reasonably expected to do more than the minimum necessary to ensure basic protection of the system?
- What is the potential that international trade agreements, laws and institutions could be used to override or impair state and local regulation of desalination facilities owned and operated by multi-national companies? This is a serious concern and is discussed below.

The profound changes in the world of water services discussed above are occurring at the same time that technological advances and the economics of desalination make it increasingly feasible for water providers along the California coast to tap into the Pacific Ocean for potable water at economic costs approaching those of currently available sources, such as water impoundments, or water imported from the Central Valley or Colorado River. While many issues associated with the shifting legal landscape of providing water services in California lie within the purview of other government bodies, such as the state's Public Utilities Commission and State Water Resources Control Board, the Coastal Commission has important responsibilities in determining consistency with coastal resource protection policies relative to direct and cumulative, short- and long-term impacts of facility siting, service area, development of infrastructure and operations of desalination facilities.

The primary Coastal Act policies implicated in the question whether desalination facilities should be private or public include several discussed later in this report – growth-inducement (Chapter 3.2.1); "coastal-dependency" (Chapter 3.2.2); feasibility (Chapter 3.2.3); and priority uses (Chapter 3.2.4).

3.1.4 The potential effects of International Trade Agreements on water services

Main Points:

- ***Recent international agreements and legal decisions relating to "free" trade may hamper the ability of state and local governments to regulate the activities of multinational corporations.***
- ***Relative to desalination proposals that may be subject to international trade rules, how would or could the ability of state and local agencies to regulate the proposed facility (e.g., siting, sizing, construction, mitigation, operation) be affected?***

INTRODUCTION

Along with the shift towards privatization is a growing body of international trade agreements and international law that is changing the governance of public resources. Recently adopted international trade agreements and agreements currently being negotiated may affect the ability of state and local agencies to review and regulate desalination projects that involve private entities with multinational ties. Conditions of the North American Free Trade Agreement (NAFTA), the General Agreement on Trade in Services (GATS), and the General Agreement on Trade and Tariffs (GATT) and resulting changes in international law have created a new generation of complex, binding and enforceable trade agreements that potentially conflict with state and local regulatory authority, and make nation-states liable for lost corporate profits and investment expectations. While providing water is currently not specifically listed as a "service" covered by the GATS, numerous water-dependent services are, and European Union (EU) proposals to include water as an "environmental service" are currently being negotiated. If this occurs, it will remove the existing ambiguity about whether the rights and exemptions contained in the GATS apply to the provision of water services. Indeed, there is a strong push from several of the more powerful trading partners to include all services unless specifically exempted.

These agreements are not limited to international activities, but also include entirely local transactions that involve a multinational corporation (MNC). The GATS defines "trade in services" broadly enough to apply to entirely local transactions if one of the entities is an MNC doing business in the territory of another member.[10] Under GATS, once a country has committed to apply GATS to a specific service sector, domestic laws relating to the provision of covered "services" must be based on "objective and transparent criteria", and not be "more burdensome than necessary."[11] Multinational corporations have been able to invoke bilateral trade agreements that allow them to evade regulatory controls and sue nation-states for lost or unmade profits[12]. As stated in a report produced for the Council of Canadians by the law firm Sack, Goldblatt and Mitchell, "When transnational corporations become partners in a public-private partnership relationship, what would otherwise be entirely a matter of domestic regulation and contract becomes subject to international trade regulation".[13] This means that an MNC based in a NAFTA-member country or another country party to a similar agreement, (of which there are many) that is intending to operate a private desalination facility in California, even if only for local water distribution could claim investor rights under NAFTA's Chapter 11. Moreover, the home country of the MNC could challenge the state's regulatory requirements under GATS, subjecting the state's regulatory requirements to legal challenge at the international level. Coastal Act policies relating to concentration of development, siting, habitat protection, agricultural preservation, or mitigation requirements for impacts related to entrainment, discharge, or runoff are likely sufficient to provoke a trade challenge and may be difficult to impose under GATS in the future. Additionally, and importantly, if an MNC invokes the WTO or NAFTA rules to challenge an action taken by the Commission or any other local or state agency, the party to the proceedings is not the agency whose action is being challenged, but the federal government.

STATUS

As noted in the previous section, the provision of water in urban areas has until recently been largely a not-for-profit public service provided by local governments through public agencies, municipal water districts, or by mutual water companies controlled by shareholders who are the consumers living within the service area. Over the last decade, however, there has been a global push and trend to privatize water supplies and treat water as a for-profit commodity. Because of global consolidation within the water industry over this period, most private entities active in the industry today are subsidiaries or affiliates of MNCs. Three MNCs (Vivendi, Suez Lyonnaise and Thames) now control more than 50% of the global water market.[14]

[10] General Agreement on Trade in Services, Article 1:2 (c), (d).

[11] Trade & Investment in Services, The Alliance for Sustainable Jobs and the Environment, 2002, p. 7.

[12] For example, Aguas del Tunari, a subsidiary of the American-based Bechtel Corporation is currently suing the government of Bolivia for $25 million in lost profits from a failed privatization scheme in the city of Cochabamba. [from "Leasing the Rain", New Yorker Magazine, March 13, 2003].

[13] *Thirst for Control*, Steven Shrybman, 2002, p. 11.

[14] *Thirst for Control*, Steven Shrybman, 2002, p. 23.

Water Privatization in California: Of the approximately two dozen desalination projects currently proposed along the coast, at least six are proposed as privately-held facilities or public/private partnerships, including two (in Huntington Beach and Carlsbad) that would be the largest coastal desalination facilities in the U.S.

Other examples in California of private entities involved in supplying water include:

- ***US Filter***, a subsidiary of the French company Vivendi, purchased 45,000 acres of farmland in the Imperial Valley with water rights totaling approximately 250,000 acre-feet per year, representing about 8% of the amount used by San Diego County.
- ***California-American Water Company*** (Cal-Am), which owns several water utilities in the state (in Sacramento, Sonoma, and Monterey Counties, and in the communities of Montara, Moss Beach, Felton, Thousand Oaks, Camarillo, Coronado, and Imperial Beach) is owned by American Water Works, which in turn is owned by Thames Water, the largest water company in England, which in turn was recently purchased by RWE, a firm based in Germany.
- ***Poseidon Resources***, proponent of the largest desalination facilities being proposed along the coast, has international partnerships with a number of companies, including Suez and U.S. Filter.
- ***OMI-Thames***, a joint venture involving Thames Water, now operates the water utility for the City of Stockton through a 20-year, $600 million contract.

Because these emerging changes in international law are evolving and subject to interpretation by private trade tribunals, they raise more questions than this report can definitively answer. It is likely that the full scope of how NAFTA and GATS will affect California's coastal management program will not be fully understood unless and until it is tested through the WTO dispute resolution process, and perhaps not even then, as the impact and implications of these treaties are constantly shifting and expanding as a result of ongoing rounds of progressive trade liberalization talks. However, with one limited exception, all challenges to environmental laws under NAFTA and GATT that have been decided have favored the MNCs. Examples include:

- California's phase-out of the gasoline additive MTBE was successfully challenged as a barrier to free trade or investment by Methanex Corporation, which is now seeking $970 million in damages.

- In Metalclad v. Mexico, the Supreme Court of British Columbia opined that NAFTA's expropriation rule, (takings provisions for foreign investors) is "sufficiently broad to include a legitimate rezoning by a municipality or other zoning authority,"[15] which could pave the way for MNCs to make international "takings" claims. Mexico was obliged to pay the Metalclad Corporation $16 million USD for lost profits when its application for a hazardous waste dump was denied. The upshot of such provisions and decisions relating to "takings" law is to give multinationals doing business in this country the benefit of more liberal compensation rules than are applicable to domestic companies.

[15] The United Mexican States vs. Metaclad Corporation, 2001 BCSC 664.

- Several countries brought a challenge to the WTO against the U.S. requirement for shrimpers to use turtle-excluding devices on their nets. The tribunal upheld the right of the U.S. to impose requirements on shrimpers who catch shrimp for sale in the U.S., but also determined that the U.S. regulations were too strict. As a result, the federal government re-wrote its regulations relating to turtle-excluding devices and on-board monitors, but weakened them substantially. Dolphin-safe tuna laws were also relaxed under similar circumstances.

By including water as part of the "services" subject to its agreements, GATS creates the potential for new and broader challenges along these lines. In the rush to address California's growing water needs, the consequences of international trade agreements constitute a profound, though not well understood, challenge to protecting public trust resources and the implementation of coastal resource protection policies pursuant to the Coastal Act at the state and local level.

COMMENTS AND POSSIBLE ACTIONS

The California Coastal Act is widely regarded among international coastal managers as the strongest, most effective integrated coastal management program. Using the GATS criteria outlined above and others, the Chapter 3 policies of the Coastal Act, if applied to covered service sectors, could potentially be interpreted as barriers to free trade, if the Commission or local government imposed permit conditions were found to be "burdensome" or "subjective" by a WTO tribunal, or because they exceed regulations imposed by other countries for similar activities. Indeed, the Coastal Act is not the only regulatory program that could be at risk. Challenges could be lodged against CEQA, the Clean Water Act, the Clean Air Act, and any other state, federal and local environmental protection law that regulates land and water use, or the quality of water, air, or other resources.

Given these risks, the state should proceed cautiously in this area, because the privatization of water and water services by multinational corporations is fundamentally incompatible with the treatment of public access to drinking water as a basic human right. It also may well compromise the ability of state and local government to effectively protect the environmental quality and integrity of life in natural and human communities

Possible Commission actions to consider include the following:

- Increase awareness and understanding of the potential impacts of international trade rules on coastal management. Legal research on this topic should focus, in addition to desalination facilities, on a broader range of coastal uses and on implementation of coastal resource protection policies by the Commission and local government. Collaboration with other state agencies and the Attorney General's office is important. Conclusions derived from the research may result in the need to adapt the Commission's deliberative and decision-making process and procedures in particular cases to specifically take into account potential issues relating to international trade rules.

- Before international trade agreements are invoked for "for-profit" water projects, undertake a thorough analysis of whether the state will be able to implement Coastal Act and other policies through existing review and permit processes without provoking a trade challenge.

- In collaboration with the Coastal States Organization (CSO), a review of this issue area should be undertaken to identify concerns in common with other coastal states so that California can be part of a unified voice before Congress calling for safeguarding state's rights relative to the implementation of coastal management programs at the state and local level.

- The Commission, in collaboration with other appropriate state agencies, California's Attorney General, the Senate Select Committee on International Trade, and the Coastal States Organization, should monitor ongoing international trade negotiations by review of trade proposals listed in the federal register and, where appropriate, provide comments to the US trade representatives and the California Congressional delegation focused on how proposed trade rules could affect implementation of California's coastal resource protection policies pursuant to the Coastal Act and federal consistency provisions of the federal Coastal Zone Management Act.

- Members of the California Legislature have repeatedly asked that state and local government regulatory authority to protect public health, safety and welfare be excluded from the operative provisions of international trade and investment agreements.[16] At the very least, states should voice their concerns and resist language that further compromises their regulatory authority. This will be difficult to accomplish, however, as one of the primary goals of the free trade agenda is to overcome problematic regulatory controls imposed by multiple levels of government. Specifically, California should request that U.S. trade negotiators support the position that water is not a "service" as defined in GATS.

[16] Letter to USTR Rep Bob Zoellick from 29 members of Ca. Legislature, dated 3/28/03; SJR 40 (Kuehl), chaptered Aug 2002.

3.2 COASTAL ACT PUBLIC RESOURCE POLICIES

3.2.1 Growth-inducement

Main Points:

- ***In some areas along the coast, the water supply provided by desalination may remove the primary constraint to growth and substantially affect coastal resources.***
- ***Determining the "growth-inducing" impacts of a particular desalination facility will vary based on its service area, the growth allowed under local coastal plans, its interconnections with other water supplies or water purveyors, and whether it is a public or private facility.***

In some areas along the coast, desalination could remove what may be the single largest constraint to growth, a limited supply of potable water. In turn, this additional supply of water could result in new and unanticipated pressures on local populations and infrastructure. Without adequately evaluating these increased stresses on local carrying capacity, the additional water available could cause growth beyond identified local or regional growth levels, and have significant adverse effects on coastal resources.

There are two main Coastal Act policies that require review of the growth-inducing effects of a proposal[17]. First, section 30250(a) states:

> *New residential, commercial, or industrial development, except as otherwise provided in this division, shall be located within, contiguous with, or in close proximity to, existing developed areas able to accommodate it or, where such areas are not able to accommodate it, in other areas with adequate public services and where it will not have significant adverse effects, either individually or cumulatively, on coastal resources…"*

By requiring new development to be located close to areas of existing development or in areas with adequate public services, this section of the Act is intended to prevent new development from outpacing the ability of local communities to provide necessary public services. This requirement is further supported by section 30254 of the Coastal Act, which states:

> *New or expanded public works facilities shall be designed and limited to accommodate needs generated by development or uses permitted consistent with the provisions of this division; provided, however, that it is the intent of the Legislature that State Highway*

[17] In addition, the CEQA Guidelines at 15126.2(d) provide further guidance on how growth-inducing impacts of proposed projects should be evaluated: "Growth-Inducing Impact of the Proposed Project. Discuss the ways in which the proposed project could foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment. Included in this are projects which would remove obstacles to population growth (a major expansion of a waste water treatment plant might, for example, allow for more construction in service areas). Increases in the population may tax existing community service facilities, requiring construction of new facilities that could cause significant environmental effects. Also discuss the characteristic of some projects which may encourage and facilitate other activities that could significantly affect the environment, either individually or cumulatively. It must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment.

Route l in rural areas of the coastal zone remain a scenic two-lane road. Special districts shall not be formed or expanded except where assessment for, and provision of, the service would not induce new development inconsistent with this division. Where existing or planned public works facilities can accommodate only a limited amount of new development, services to coastal dependent land use, essential public services and basic industries vital to the economic health of the region, state, or nation, public recreation, commercial recreation, and visitor-serving land uses shall not be precluded by other development.

Taken together, these policies generally require new development be located within or next to existing developed areas able to accommodate such development or in other areas with adequate public services, and provide that the size of public works facilities be based on the ability to maintain, enhance, or restore coastal resources. New development must also conform to the policies and standards contained in any applicable Commission-certified LCPs. These policies may relate to regional water and growth management goals or how limited water resources are allocated.

EVALUATING THE GROWTH-INDUCING IMPACTS OF COASTAL DESALINATION PROPOSALS

For purposes of Coastal Act review, a primary issue to be addressed is how the growth induced by a development might affect coastal resources. The review and evaluation of a facility's potential growth-inducing impacts may cover a range of questions and issues, depending on the characteristics of the proposal. Questions and issues that may be addressed include:

What is the project purpose?

- Is the project meant to provide a new supply of water or to replace an existing supply? If it is providing a new supply of water, project review will need to consider whether growth related to the increased availability of water would occur within the limits identified through Local Coastal Programs or other local or regional planning efforts. If meant to be a replacement source, desalination may provide an opportunity to reduce or eliminate adverse impacts associated with the use of an existing water supply. For example, desalination could reduce or eliminate withdrawals from surface water bodies, resulting in more natural streamflows and improved fish or wildlife habitat. If desalination is meant to replace groundwater withdrawals, it could, in some areas, reduce subsidence or seawater intrusion. In areas where drinking water sources have been contaminated, desalination could provide an alternative source of potable water while allowing necessary treatment or remediation of the contaminated surface or groundwater source. In either case, ongoing public oversight of the facility's operations and water distribution is likely to better ensure that the supply is used as proposed and evaluated.

  When a proposal for a desalination facility is based on its replacing an existing supply and therefore avoiding or minimizing growth-inducing impacts, the review will need to identify the specific measures that assure the existing supply will be retired. For example, if a facility is proposed as a means to replace water currently being withdrawn from a river, the proposal or the permit should include specific measures as to how that water will remain in the river for non-consumptive purposes.

Example: The California-American Water Company (Cal-Am), which supplies water to parts of the Monterey Peninsula, is proposing a desalination facility to replace a portion of the water supply it currently withdraws from the Carmel River. Other entities are considering whether the proposed facility might also be used to provide a new and increased source of water for other areas. The two proposals would require significantly different analyses of growth-inducing impacts.

- Is the project meant to provide a baseline supply of water or to be used only for emergencies or drought relief? Projects meant to provide emergency supplies only are likely to have fewer growth-related impacts than projects providing an ongoing baseline supply. If a proposed project is intended to provide only emergency or drought-related water supplies, and evaluation under the Coastal Act reviews only those intended purposes, then any permit issued for such a project will likely include conditions requiring additional review if the capacity of the project changes.

What form of ownership and oversight is provided?

- Is there adequate public oversight for the facility? As stated in sections 30250(a) and 30254 above, new development must be tied to the capabilities of public services and public works facilities. Public control of desalination facilities would generally provide mechanisms to ensure the capacity is linked to local growth management plans, goals, and priority uses, and would allow the necessary involvement by the interested public in decision-making. Public ownership is also likely to allow for a more comprehensive approach to resolving issues related to regional growth, the types of development to be considered, and the directions in which it occurs. Review under the Coastal Act is likely to require specific evaluation of whether private desalination facilities will implement the level of public oversight, decision-making, and consolidation of public interests necessary to ensure public resources are properly managed.

- Is the development a "coastal priority"? The form of ownership and oversight of water supplies provided through desalination may be most significant in areas where water is a limiting factor in allowing additional development. Without adequate public oversight, new development capable of providing its own water may be able to proceed while other higher priority development may not. The Coastal Act mandates that certain types of development along the coast receive priority over other types. These include visitor and recreation facilities (in section 30213), facilities designed to enhance public opportunities for coastal recreation (section 30222), aquaculture facilities (section 30222.5), facilities serving commercial fishing and recreational boating (section 30234), and coastal-dependent development (section 30255). Therefore, a proposed non-priority development that includes desalination capability may reduce the ability for priority developments to occupy coastal areas. [See also Chapter 3.2.]

What is the service area?

· Is the service area for the water defined? A desalination facility may be intended to provide water to a specific service area of known end users, or may be meant to provide water to a more extensive or less well-defined service area. Determining the growth-inducing impacts of a proposal must include a description of the service area, the maximum build-out of that area, and how much growth could be a result of the water supply provided by the facility. The review also considers whether the water produced is subject to delivery requirements and restrictions, long-term contracts, or other binding agreements. It may also be necessary to identify the capabilities and limits of the associated infrastructure, such as the ability of existing or proposed water pipelines to delivery water to the service area.

The review will also consider whether the facility's location will result in changes to the delivery area. For example, a desalination facility built at some distance from its service area may result in pressure to provide a water supply nearer the facility. In some less developed areas, this could lead to growth outside of existing service boundaries and could provide for growth beyond levels incorporated into local planning efforts.

The complexity of this review will vary based on several issues. Review for growth-inducement and its effect on coastal resources will be simpler in cases where the service area is well defined, the distribution system is not connected to other systems, and where the level of development or build-out within the service area is known. Review will be much more complex and difficult for large-scale proposals that would provide water through a connected series of distribution systems to a much larger service area both within and outside the coastal zone. For example, desalinated water produced along the Southern California coast and distributed through the Metropolitan Water District's system could affect water supplies from Ventura to San Diego and inland as far as east as Riverside and San Bernardino Counties. Determining how growth induced by this additional water will affect coastal resources will be challenging.

As trends towards water marketing and the potential for interbasin or even international water transfers increase, any difference in oversight over public or private facilities is likely to have more far-reaching growth-inducing consequences. Longer distance transfers also raise issues associated with determining whether local impacts to coastal resources can be mitigated by benefits that may accrue elsewhere, including some that may occur some distance from the coast.

POTENTIAL MITIGATION MEASURES TO AVOID OR MINIMIZE GROWTH-INDUCING IMPACTS

Possible mitigation measures that will likely be evaluated to avoid or minimize impacts include:

- ***Implement local or regional water conservation and reclamation measures to reduce the need for new water projects:*** In some areas, effective water conservation and reclamation measures may, in many cases, provide as much or more water than a proposed desalination project at less cost and with fewer adverse effects. Review of a

proposed project should identify measures such as these as part of the alternatives analysis done for a proposed facility.

- ***Link plant capacity to the planned level of development authorized by the certified Local Coastal Program for the area:*** Desalination plants and their accompanying water distribution system should be sized to match the planned level of development authorized by an area's certified Local Coastal Program. The design, review, and approval of proposed projects should include a description of the anticipated level of development, and should tie the permitted activity to that particular development level. This includes assessing the long-term growth-inducing potential of projects.

  This issue has been addressed in some previous Commission decisions on similar projects involving growth-inducing impacts. For example, the permit for a water supply pipeline included a condition requiring the permittee to apply for an amendment if the proposed development in the area went above a specific level.

- ***Siting plants near existing water distribution systems and energy sources:*** This may allow a desalination facility to operate using existing infrastructure for both water supply and energy, and not require additional infrastructure build-out and the growth that may be associated with such a build-out.

3.2.2 "Coastal-dependent" and "coastal-related"

Main Points:

- ***Desalination, in and of itself, is not "coastal-dependent".***
- ***While desalination processing facilities are not likely to be considered "coastal-dependent", their associated pipelines may be.***
- ***If the pipelines for a desalination facility using seawater are considered "coastal-dependent", the associated processing facility would be considered "coastal-related".***

The Coastal Act includes policies that acknowledge the limited amount of coastal land in California, the need for certain activities to be located on the coast, and the public's interest in having land available for those activities and uses. One of the primary determinations that must be made during review of many proposals is whether a proposed project is "coastal-dependent" or "coastal-related". Section 30101 of the Coastal Act defines a "coastal-dependent development or use" as "any development or use which requires a site on, or adjacent to, the sea to be able to function at all". Section 30101.3 of the Act defines a "coastal-related development" as "any use that is dependent on a coastal-dependent development or use".

Is desalination "coastal-dependent"? While a facility dependent on seawater may, at first glance, appear to fit this definition, desalination, in and of itself, is not a coastal-dependent development or use. Many desalination facilities are located at inland locations where the source water is brackish water, groundwater, reclaimed water, or similar sources other than seawater. Similarly, providing water supply is not necessarily a coastal-dependent use, as most potable water is provided from sources other than seawater.

While a desalination facility itself is not coastal-dependent, the pipelines for getting seawater to and from the facility may be. The desalination processing facility may only need to be located close to the coast in an area reachable by the pipelines, and not necessarily adjacent to the ocean.

> ***Examples:*** In a decision on a previous project, the Las Flores Canyon oil and gas processing facility in Santa Barbara County, the Commission found that the pipelines providing oil and gas from offshore oil platforms were considered "coastal-dependent", and also found that the facility used to process the oil and gas was not "coastal-dependent". However, because it was dependent on the use of those "coastal-dependent" pipelines, the processing facility was considered "coastal-related."
>
> Similarly, the Commission has determined in several instances that aquaculture dependent on seawater is not necessarily "coastal-dependent", since it, too, can be located at some distance inland from the shoreline.

The determination of whether a proposal is "coastal-dependent" is important for proposed developments in several ways:

- Priority uses: Recognizing the limited amount of coastal land in the state, the Coastal Act includes several policies that prioritize coastal-dependent development for coastal areas. Section 30255, for example, states that coastal-dependent development has priority over other development on or near the shoreline and that it should be within reasonable proximity of the coastal-dependent uses it supports. [Priority uses are discussed further in Chapter 3.2.4.]

- Placing fill: To place fill in coastal waters, a proposed development must fall within one of the eight categories listed under section 30233(a) of the Act[18]. Only one of these eight

[18] Section 30233(a): The diking, filling, or dredging of open coastal waters, wetlands, estuaries, and lakes shall be permitted in accordance with other applicable provisions of this division, where there is no feasible less environmentally damaging alternative, and where feasible mitigation measures have been provided to minimize adverse environmental effects, and shall be limited to the following:

(l) New or expanded port, energy, and coastal-dependent industrial facilities, including commercial fishing facilities.
(2) Maintaining existing, or restoring previously dredged, depths in existing navigational channels, turning basins, vessel berthing and mooring areas, and boat launching ramps.
(3) In wetland areas only, entrance channels for new or expanded boating facilities; and in a degraded wetland, identified by the Department of Fish and Game pursuant to subdivision (b) of Section 30411, for boating facilities if, in conjunction with such boating facilities, a substantial portion of the degraded wetland is restored and maintained as a biologically productive wetland. The size of the wetland area used for boating facilities, including berthing space, turning basins, necessary navigation channels, and any necessary support service facilities, shall not exceed 25 percent of the degraded wetland.
(4) In open coastal waters, other than wetlands, including streams, estuaries, and lakes, new or expanded boating facilities and the placement of structural pilings for public recreational piers that provide public access and recreational opportunities.
(5) Incidental public service purposes, including but not limited to, burying cables and pipes or inspection of piers and maintenance of existing intake and outfall lines.
(6) Mineral extraction, including sand for restoring beaches, except in environmentally sensitive areas.
(7) Restoration purposes.
(8) Nature study, aquaculture, or similar resource dependent activities.

categories (Category 1 – port, energy, and coastal-dependent industrial facilities) is likely to apply to desalination, but only for those portions of the facility (i.e., the intake and outfall pipelines) that have been determined to be coastal-dependent[19]. Further, the development allowed under this policy is subject to two additional measures – there must be no feasible less environmentally damaging alternative, and feasible mitigation measures must minimize adverse environmental effects.

Unless designed and operated to avoid impacts, seawater intakes and outfalls are likely to cause adverse effects to coastal resources, primarily due to pulling marine organisms into the pipelines and discharging highly saline brine to the water column [See Chapter 4.2.] Therefore, the review for proposed pipelines will likely need to determine whether there are alternative locations, including other water sources, or alternative methods, such as beach wells, infiltration galleries or other types of subsurface intake or outfall locations, as well as existing intakes and outfalls, that would reduce those impacts.

- Proposals that don't fully meet applicable Coastal Act policies: Section 30260 of the Act recognizes that some facilities that are "coastal-dependent" may not conform to all applicable policies of the Coastal Act:

  > *Coastal-dependent industrial facilities shall be encouraged to locate or expand within existing sites and shall be permitted reasonable long-term growth where consistent with this division. However, where new or expanded coastal-dependent industrial facilities cannot feasibly be accommodated consistent with other policies of this division, they may nonetheless be permitted in accordance with this section and Sections 30261 and 30262 if (1) alternative locations are infeasible or more environmentally damaging; (2) to do otherwise would adversely affect the public welfare; and (3) adverse environmental effects are mitigated to the maximum extent feasible.*

  This section, therefore, provides that coastal-dependent industrial facilities not consistent with other applicable policies of the Coastal Act may be permitted if the Commission finds that they meet a three-part test:
  - Are alternative locations infeasible or more environmentally damaging?;
  - Would doing otherwise adversely affect the public welfare?; and,
  - Are adverse environmental effects mitigated to the maximum extent feasible? [See Chapter 3.2.3 below for a description of "feasible".]

Similar to the tests described above for proposals involving placing fill, the review of desalination pipelines considered "coastal-dependent" will need to evaluate whether there are other feasible or less environmentally damaging locations and determine what measures are needed to mitigate adverse environmental effects to the maximum extent feasible. Again, this review is likely to include an evaluation of whether the facility can be located and operated to

[19] Category 5 of this policy, which includes "incidental public services" has generally been intepreted by the Commission to include only temporary impacts, such as construction- or maintenance-related activities. The Commission has not interpreted this section to allow ongoing impacts that might be associated with an open intake, such as entrainment or impingement of marine species.

avoid entraining and impinging marine organisms and whether the outfall can be designed to avoid or minimize harmful discharges of high salinity brine to the ocean.

3.2.3 "Feasibility"

Main Points:

- ***Determining "feasibility" is a key requirement in many Coastal Act policies applicable to desalination facilities.***
- ***Proposed facilities will likely include many elements in which feasible alternatives and mitigation measures will need to be identified and incorporated into project design and operation.***

"Feasible" is defined in both the Coastal Act and CEQA as "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors".

The Coastal Act includes a number of provisions requiring that feasible methods be used to protect coastal resources. This requirement is an element of one of the Act's goals – to "protect, maintain, and where feasible, enhance and restore the overall quality of the coastal zone environment and its natural and artificial resources" (Section 30001.5) – and it is also required in a number of the Act's specific policies and provisions. Several policies require that alternatives considered and mitigation measures required be feasible.

Feasibility is likely to be an issue during review of proposed desalination facilities for many Coastal Act policies. Some examples of how the factors included in the definition above may be incorporated into review include:

- ***Economic feasibility:*** Assessing economic feasibility will likely require determining the direct costs of various mitigation measures and evaluating those costs along with the environmental impact being addressed and the proportion of those costs to the overall project costs. Because some unmitigated environmental impacts of desalination may be significant, and because large-scale desalination facilities may have relatively high costs for both construction and operation, the alternatives and mitigation measures deemed feasible will likely include some that are costly, though not in proportion to overall project costs. In some cases, economic feasibility may also include determining the opportunity costs gained or lost by using a coastal site for one activity rather than another. This is generally an element of the Coastal Act policies related to priority uses, but may also be included in feasibility in some instances.

- ***Environmental feasibility:*** Environmental feasibility is important in considering appropriate measures to reduce project impacts. There should be reasonable assurance when selecting mitigation measures that they can be implemented successfully and have a strong likelihood of successfully addressing the impacts to be mitigated.

- ***Social feasibility:*** Social feasibility refers to a number of issues related primarily to the public's acceptance of certain measures, and how the acceptability (or lack of it) affect an

element of a proposed project. Probably the primary example of this issue as it relates to desalination is the potential to desalinate treated wastewater to provide a water supply. While this alternative has significant benefits related to the other factors of feasibility – it is technologically feasible, it is economically less expensive than desalting seawater, and in many areas, it would be environmentally preferable to discharging the waste to the ocean – at the current time, it is likely to be seen as less acceptable to the public.

- ***Technological feasibility:*** Technological feasibility refers to the basic design, engineering, and operational ability to implement an alternative or mitigation measure. For desalination, an example may be using ultraviolet light to treat water rather than using chemicals that may persist in the water column. This type of feasibility may also show up during review when considering combined benefits – for example, a facility near the ocean affecting views may be required to put up screens or panels that improve the visual component of the facility, but also reduce its exposure to salt spray or wind.

Additionally, and as described in Chapter 3.2. above, in instances where a proposed "coastal-dependent" facility does not conform to one or more of the above Coastal Act policies, it may still be approved subject to provisions of Coastal Act section 30260, which requires the adverse environmental effects of the proposal to be mitigated to the maximum extent feasible. When desalination intake and discharge pipelines are determined to be "coastal-dependent", this standard is likely to require extensive review, not only for determining the level of feasibility, but because the unmitigated adverse effects of entrainment and brine discharge are likely to be significant.

Review for a desalination proposal, therefore, will likely require an alternatives analysis to identify whether there are other feasible alternatives that better conform to Coastal Act requirements. Some examples of possible alternatives include:

Conservation measures: This could include any number of measures, from incentive-based or voluntary steps implemented by public or private entities (e.g., urging landowners to use drought-resistant native plants instead of landscaping heavily dependent on irrigation) to regulatory requirements (e.g., requiring new developments to use low-flow water fixtures only).

As part of a desalination proposal, an applicant should be prepared to provide or evaluate any existing conservation measures being implemented in a proposed service area, whether there are comprehensive water use reduction plans in place, and the effectiveness of such measures in plans in reducing overall water consumption.

Using reclaimed or recycled water: This will likely depend on the availability of nearby sources, the infrastructure needs to make these sources available to end users, the degree of certainty that those sources will be available when needed, and other similar factors.

Reallocating existing supplies: This could include a number of approaches, such as retiring existing water rights.

Market-based measures: This could include measures such as trading water rights, using a rate structure that charges different amounts for different sources of water or for water use during different times of day.

3.2.4 Priority Uses

Main Points:

- ***In many cases, review of a proposed desalination facility will need to evaluate how it affects or supports priority uses along the coast.***
- ***The review for determining conformity to the Coastal Act's priority use policies is likely to differ for public or private desalination proposals.***

The Coastal Act establishes several types of priority uses for lands in the coastal zone to ensure that uses strongly associated with the coast are able to remain viable. These types of uses and development (and the corresponding sections of the Coastal Act where they are listed) include:

- Lower-cost visitor and recreation facilities (Section 30213).
- Visitor-serving commercial recreational facilities designed to enhance public opportunities for coastal recreation (Section 30222 – this section also prioritizes those facilities over private residential, general industrial, or general commercial development, but not over agriculture or coastal-dependent industry).
- Aquaculture facilities (Section 30222.5).
- Upland areas for coastal recreation (Section 30223).
- Recreational boating and associated facilities (Section 30224).
- Commercial fishing and recreational boating facilities (Section 30234).
- Prime agricultural land (Section 30241).
- Coastal-dependent development (Section 30255).
- Priority developments must not be precluded by other development due to the limited capacity of public works facilities (Section 30254).

These designations do not mean that these are the only uses that can be located along the coast; however, part of review under the Coastal Act may include consideration of whether the site of a proposed development is suitable for the priority uses. The review may consider at least two aspects of priority use policies for a proposed facility:

- ***How will the facility itself affect priority uses?*** A desalination facility located on or adjacent to coastal sites suitable for higher-priority developments could remove or reduce land available for such developments. Desalination facilities may result in several types of adverse effects on coastal resources – visual, noise, public access, water quality, etc. – any of which, even if mitigated, could reduce the ability of priority developments to be sited nearby. This would in turn diminish the coastal uses associated with these priority developments, and may therefore be inconsistent with Coastal Act goals. For example, in a decision several years ago, the Commission determined that a desalination facility being considered in the coastal zone near the cities of Marina and Seaside would diminish public access and recreational opportunities in that area, and further concluded that a feasible, less environmentally damaging alternative site was available east of Highway 1 away from the shoreline area.

- ***How will the water supply provided by the facility affect priority uses?*** Similar to the above, the water supply provided by a facility may allow development in areas that have either been used for priority uses or are suitable for such uses. The increased development pressures on these areas may result in non-priority development, especially if the desalination water supply is more costly than certain priority uses can afford – for example, agriculture and low-cost visitor serving facilities are not likely to afford water than could easily be afforded by a high-cost visitor facility.

EFFECT OF PUBLIC OR PRIVATE OWNERSHIP ON PRIORITY USES

Priority use policies raise at least two additional issues related to whether a facility would be publicly or privately owned:

- Whether non-priority development that includes its own water supply might be able to proceed at the expense of priority development that may not be able to provide its own supply;
- Whether a private desalination facility would allocate water in a manner reflecting the same priorities as a public facility.

Regarding the first issue, the types of development prioritized in the Coastal Act do not necessary come with their own water supply. In areas where development is limited by the available water, private facilities that provide their own water might be able to proceed while other higher priority developments that do not have the ability to provide their own water might not. A private, non-priority development could therefore override Coastal Act preferences for priority coastal uses or might not be subject to water allocation decisions made by a local public water purveyor. Because desalination remains a relatively costly process, a development's ability to provide its own desalinated water may be largely based on financial considerations rather than whether the proposed development is recognized as a priority development for coastal areas. A lower-cost visitor and recreation facility, for instance, may not be able to compete with the ability of a higher-cost facility to provide its own water, and so a coastal site suitable for either type of development may end up used by the latter at the expense of the former. One other consequence of this issue could show up during difficult financial times, in that a private development dependent on its own water supply may, for various reasons, no longer be able to afford the costs of desalination and instead increase the burden on the local public water purveyor. This additional burden could further limit the ability of public agencies to allocate water or land to priority coastal uses. A similar resource-allocation issue may arise due to the relatively high electrical demand associated with desalination, in that the demand from a desalination facility used by a non-priority development could limit or preclude the ability of local electrical supplies to support priority developments.

Regarding the second issue, public ownership and oversight of desalination facilities, especially in areas with certified LCPs, is more likely to ensure that water allocations will occur in a manner consistent with the priority developments identified in the Coastal Act and in the LCP. Allocations from public facilities are likely to be subject to more ongoing public review, whereas allocations from private facilities may be primarily market driven and might not adequately reflect Coastal Act priorities. This difference in how public or private entities might allocate

water is likely to be moderated in areas where the state Public Utility Commission has provided exclusive retail rights to a municipal water district. In these areas, a private desalination facility would be able to act only as a water wholesaler and sell only to the water district where the allocation decisions would be made.

CHAPTER 4: COASTAL ACT POLICIES RELATED TO THE POTENTIAL ENVIRONMENTAL EFFECTS OF DESALINATION

This chapter focuses on the possible effects of desalination on marine biological resources and water quality, and discusses some elements that are likely to be evaluated as part of coastal development permit review. It also describes several unique issues associated with proposals to co-locate desalination facilities with coastal power plants using ocean water in their once-through cooling systems.

The chapter also briefly describes other Coastal Act policies that will likely be involved in reviewing proposed desalination facilities. For these policies, including those involving public access, recreation, spill prevention, and others, the effects of a desalination facility will likely be similar to the other types of developments. This chapter provides only a general description of desalination facility effects on these other coastal resources. This should not be construed as treating these coastal resources as less important; only that they are likely to be evaluated in ways similar to many other developments that have undergone review under the Coastal Act.

4.1 POTENTIAL IMPACTS ON THE MARINE ENVIRONMENT

Main Points:

- ***Desalination facilities can cause significant adverse effects on marine organisms if not properly designed, sited, and operated.***
- ***The review of desalination intakes and outfalls will require evaluation of alternative locations and feasible mitigation measures to avoid or reduce these impacts.***
- ***Reviewing desalination facilities proposed to co-locate with coastal power plants will require consideration of some unique issues to ensure conformity to some Coastal Act policies.***

The two main elements of desalination facilities likely to cause impacts to marine life and water quality are the seawater intake system and the brine discharge system. While both can cause significant adverse effects, both can be designed and operated to minimize or completely avoid those impacts. The primary Coastal Act policies related to marine biological resources and water quality are:

Section 30230:

> *Marine resources shall be maintained, enhanced, and where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.*

Section 30231:

> *The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment, controlling runoff, preventing depletion of ground water supplies and substantial interference with surface water flow, encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams.*

These policies establish a strong standard for protecting water quality and marine life, and recognize seawater is more than just water; it provides significant habitat for numerous species. Among other things, the policies require the maintenance, enhancement, and where feasible, restoration of marine resources, sustained biological productivity, and minimization of entrainment-related effects. The review of proposed desalination facilities will likely require determining an appropriate environmental baseline and evaluating appropriate alternatives and mitigation measures that avoid or reduce adverse effects to the marine community and water quality.

The Coastal Act also contains several policies related to commercial and recreational fishing, including Section 30234.5, which states:

> *The economic, commercial, and recreational importance of fishing activities shall be recognized and protected.*

This section of the report includes two main areas – a discussion of the potential environmental effects and mitigation measures for operating new desalination intakes and outfalls, and a discussion of proposed facilities that would use the existing intakes or outfalls of an existing coastal power plant. Review of proposed facilities will also require evaluation of the siting and construction-related impacts of new intake and outfall structures. This review will be similar to reviewing other types of development involving placing fill in the water, and would evaluate measures needed to avoid or minimize effects on sensitive habitat, such as hard bottom substrate, kelp forests, or habitat used by sensitive species, and determining how the structures might affect public access, recreation, navigation, and other coastal resources and uses.

4.1.2 Environmental Effects of Operating Proposed New Desalination Intakes

The primary adverse effects caused by the operation of desalination intake systems are impingement and entrainment:

- ***Impingement:*** Impingement refers to the injury and death caused by trapping marine life against intake screens due to the velocity of the intake water. The rate and degree of impingement is largely a function of water velocity, intake design, and intake location.

- ***Entrainment:*** Entrainment refers to the death of the relatively small marine organisms, such as plankton, larvae, and fish eggs, that are pulled through the intake screens and into the processing system of a desalination facility or through the cooling system of a power plant. The organisms are killed due to being trapped against filters or being subjected to the higher pressures or temperatures within the systems. Entrainment due to power plant once-through cooling systems can cause significant adverse environmental impacts. Coastal power plants using hundreds of millions of gallons per day of ocean water can entrain trillions of organisms, causing substantial changes to the local or regional biological community.

  For purposes of determining impacts, the rate of mortality due to entrainment in power plants is considered to be 100 percent. Desalination facilities would result in the same mortality rate, since the seawater is filtered or treated to remove particles during the desalting process. The degree of entrainment at a facility is primarily a function of the amount of water used and the location of the intake.

ALTERNATIVES AND MITIGATION MEASURES

The two primary types of seawater intake systems are subsurface and surface:

Subsurface intakes: Subsurface intakes, such as beach wells or infiltration galleries, are buried below the water column and use the overlying substrate as a natural filter. The amount of water that can be taken in by subsurface intakes is a function of the type of substrate, its permeability, and other geotechnical characteristics. Properly designed subsurface intakes are likely to completely eliminate impingement and entrainment impacts. Additionally, in some areas, they can be located either on the shoreline or at some distance inland if water is available below the surface due to naturally occurring or induced seawater intrusion. With low intake velocities and an appropriate cover layer, beach wells or infiltration galleries can operate with little noticeable effect on local marine life. They may create an additional operational advantage by providing some part of the pre-treatment necessary before the seawater goes through the desalination membranes, thus eliminating part of the chemical or physical treatment that would otherwise be required. While subsurface intakes are likely to be more costly to construct, they may result in long-term operational savings due to this pre-treatment and lower chemical use.

The feasibility of subsurface intakes depends in part on having an appropriate substrate that provides the necessary permeability. Some substrates may be suitable but have less permeability, which would require a larger overall intake system with multiple wells or galleries to draw in the desired amount of water. Some locations, such as those with deep deposits of mud or unfractured rock, are not likely to be suitable for subsurface intakes. Additionally, the design of a subsurface intake system should take into account the composition of the substrate to ensure it will not clog or foul over the long-term facility operations.

Review of proposed facilities will likely include an evaluation of whether subsurface intakes can be used to avoid or minimize the impingement and entrainment effects associated with open water intakes. Of the existing dozen or so desalination facilities along the coast, four use beach wells as their feedwater system. Of the two dozen or so proposed facilities, at least six are considering using beach wells.

Surface intakes: These generally consist of an open pipe taking water directly from the water column. Most are screened or have some type of barrier to prevent larger material from moving into the intake. Intakes at coastal power plants often have velocity caps, which are structures that fit over the intake several feet away from the opening and reduce and change the direction of the intake water velocity, allowing fish to react more quickly to the velocity change and escape the intake system.

While using screens and velocity caps reduces the impingement caused by surface intakes, entrainment effects are likely to remain, since most of the entrained organisms are too small to be screened out without significantly reducing the intake water volume. Further, the rates and types of entrainment vary significantly based on the location and depth of the intake, as well as where the intake is sited in relation to areas of biological importance (e.g., at the mouth of a bay or estuary, downcurrent of an area of ocean upwelling, etc.). Therefore, review of proposed new surface intakes will likely require a substantial evaluation of appropriate locations, water depths, and mitigation measures that would reduce entrainment effects. The review will generally include a determination of whether subsurface intakes are feasible for the proposed facility and location.

The most commonly recognized study for determining entrainment effects of ocean water intakes is known as the "316(b)" study, named after a section of the federal Clean Water Act. These studies are used to evaluate the impacts of once-through cooling systems used by thermal power plants, and are also used to determine what alternatives and mitigation measures should be used at the power plants to minimize these impacts. A 316(b) study requires sampling at various depths of the water column over the course of a year at both an intake site and a control site to identify the types and concentrations of species that would be entrained. The study then uses any of several models to determine what effect the entrainment has on the adult fish population or broader marine community of the source water.

Several power plants along the California coast have recently completed entrainment studies using protocols equivalent to those used in 316(b) studies. These recent studies were done as part of the review process required by the California Energy Commission under both the California Environmental Quality Act (CEQA) and the Warren-Alquist Act (which regulates power plant siting and operations in California) for power plant upgrades and installation of new generating units. The recent studies also served to update previous studies done in the 1970s and 1980s, and to determine the existing baseline conditions at the various sites.

Reviewing desalination facilities that propose to use open water intakes will require some form of entrainment study. The default protocols for these studies will generally be those used in the 316(b) studies, though in some cases, different protocols may be proposed. In some cases, the review may be able to use other recent and local entrainment data – for example, a recently completed 316(b) study – if applicable to the proposed desalination site.

4.1.3 Environmental Effects of Operating New Desalination Outfalls

The primary adverse impacts related to a desalination discharge are due to the high salinity brine and other chemicals or cleaning compounds that may be discharged:

Brine discharge: The brine discharged from a desalination facility can have salinity levels up to about twice the normal level for seawater. The ambient salinity level in seawater varies to some degree due to seasonal changes, upwellings, or other natural phenomena, but usually not to the degree caused by a discharge of brine from a desalination facility. Local species are usually adapted to the changes in ambient salinity but few are likely to be unaffected by the much higher salinity in desalination brine.

Discharge of biocides, cleaning compounds, and other chemicals: Seawater desalination facilities require the use of a variety of chemicals and compounds to treat the water, clean the desalting equipment, and prepare the desalted water for distribution through the water supply system. Many of these compounds are neutralized or removed from the brine stream before being discharged; however, other compounds are likely to remain in the brine stream. Chemicals that are during the desalination process included chlorine, ozone, or other biocides, various coagulants, acids, antiscalants, and others. Some desalination facilities may use materials that corrode during processing, adding metals or other compounds to the discharge stream.

ALTERNATIVES AND MITIGATION MEASURES

Similar to intake systems, seawater desalination facilities can use both surface and subsurface discharge systems. Both will require determination of allowable levels of salinity and concentration of chemicals to ensure water quality standards are met and biological communities are not adversely affected.

Among the alternatives that will likely require review is on-land disposal of brine and chemicals resulting from desalination, or disposal of all or part of the discharge stream to a wastewater treatment system. During membrane cleaning, for example, chemical concentrations in the water are likely to exceed levels allowed to be discharged into the ocean, and will therefore require alternative disposal. The feasibility of alternatives to inwater disposal will depend on a number of factors, including the volume and constituents of the discharge stream and the availability and capacity of local treatment systems.

For discharges of the waste stream to open water, several mitigation measures may reduce the effect of both brine and chemicals on the water column and biological community. These include using non-corrosive or less corrosive materials in the facility and adequate pre-discharge treatment of the chemicals to ensure they are neutralized. The review of proposed facilities may also consider the types and amounts of chemicals proposed to be used and evaluate whether there are less persistent or less harmful chemicals or methods that would achieve the same treatment purpose (e.g., using ultraviolet light instead of biocides). Structural features that disperse the discharge, such as diffusers of multiport outfalls, may also be considered as mitigation measures to reduce the overall impact of the brine and chemical discharges.

Discharges to the ocean will also be subject to review and permitting by the Regional Water Quality Control Boards for an NPDES (National Pollutant Discharge Elimination System) permit, and will likely be subject to ongoing monitoring requirements.

4.1.4 Environmental Effects and Issues Related to Co-location of Desalination Facilities and Coastal Power Plants

Some of the largest desalination facilities currently being considered are proposed to be located at existing coastal power plants here in California. These "co-located" proposals involve some unique issues described in this section.

Co-location is seen as advantageous for several reasons, including:

- ***Water use:*** The power plants use up to hundreds of millions of gallons per day of ocean water to cool their generating units. The desalination facility would use a portion of this water as its source water. If the desalination facility operated in concert with the power plant and withdrew water only after it was used during the cooling process, the desalination facility would not increase entrainment beyond what was already caused by the power plant.

  Additionally, the higher salinity brine from the desalination facility can be discharged to the power plant outfall and mixed with what is usually a much larger volume of seawater, thus allowing some degree of dilution before the combined discharge enters the ocean water.

- ***Existing intakes and outfalls:*** The desalination facility would use the plant's existing intake and outfall structures, thus eliminating the need for new inwater structures.

- ***Available electricity:*** The power plant could provide much of the energy needed by the desalination facility. This could allow the desalination facility to be built with less need to increase transmission capability elsewhere on the energy grid, although this benefit may need to be considered as part of the facility's effect on local or regional electrical demand. Additionally, in some cases, a co-located desalination facility may be able to pay less for the electricity due to low or no transmission costs, which could result in significant cost savings.

- ***Other existing infrastructure:*** Much of the existing infrastructure needed by the desalination facility – access, parking, security, etc. – may already in place. Additionally, many desalination facilities are likely to be relatively small in scale compared to the power plants, so their visual impacts may be subordinate to the existing visual effects of the power plants.

Along with these advantages, proposed co-location raises several issues that are different from those involving independently-sited desalination facilities. Review for conformity to Coastal Act policies is likely to be different for proposed co-located desalination facilities than for independently-sited facilities. Some of the issues to be considered are:

Entrainment: While a co-located desalination facility is likely to cause less entrainment than one using a separate intake structure, it may still result in significant adverse entrainment losses. There are several components of co-location that should be evaluated during project review:

- Location: Most coastal power plants were designed and sited about 50 years ago. The designs and locations of these plants do not reflect current understanding of the effects once-through cooling on the marine biological community. Some cooling water intakes are located in areas where the biological resources have been, and continue to be, entrained at very high rates. Even if a proposed desalination facility would not significantly increase the entrainment rate, the existing effect must be taken into account when determining an appropriate intake location. For some proposed facilities, an alternative intake location could reduce or entirely avoid entrainment effects that may occur at an existing power plant cooling system.

- Coordinated operation of the two facilities: Project review should identify how the operations of the two facilities will be coordinated. Desalination facilities located at power plants that provide baseload energy and thus operate continually will likely create far fewer independent entrainment impacts than those located at power plants operating only during peak energy demands. However, power plants are often shut down for various lengths of time due to maintenance requirements or market conditions. Desalination facilities that continue to operate when the power plant is shut down will cause entrainment that would otherwise not be occurring. Even when power plants continue to circulate ocean water when they are not producing electricity, the desalination facility is likely to cause entrainment independently, as the entrainment mortality rate is likely lower when the marine organisms are not subjected to the high temperatures of the power plant generating units. Additionally, many power plants have multiple generating units or multiple intakes for those units, so the review for the desalination facility may also evaluate whether it is feasible to locate the facility at the intake that operates the most, or it the facility can take water in from whichever intake units are operating.

- Applicable entrainment data: Entrainment studies for most coastal power plants along the California coast date from the 1970s and 1980s. The data from these studies are generally not adequate to determine the existing and ongoing level of impact caused by the power plant's once-through cooling system. Studies done in the 1970s or 1980s do not reflect more recent improvements in study protocols, sampling techniques, species identification, and modeling, and are not based on the improved scientific understanding of marine ecosystems. Additionally, while most of the power plants have been reviewed at various times for conformity to state and federal water quality standards or state energy-related requirements, most have not been reviewed for conformity to Coastal Act policies. Therefore, there is no "baseline" of environmental effects that can be used during Coastal Act review.

Change in Use: The long-term operating relationship between the two facilities should also be evaluated during permit review, including issues related to:

- Temporary or permanent change in power plant operations: The once-through cooling systems of most coastal power plants are several decades old and do not reflect current understanding of environmental siting constraints, improved intake designs, or better understanding of the ecological effects of entrainment. As these power plants undergo review for proposed new generating units or continued use of their cooling systems, new requirements may result in replacement of these once-through systems with less environmentally harmful systems that use dry cooling, recycled or reclaimed water, or other methods. Additionally, in February 2004, the U.S. EPA is scheduled to update rules related to the allowable level of adverse environmental effects associated with once-through cooling. These new rules could reduce the advantages of co-location if they require significant design or operational changes to the power plant to decrease levels of entrainment, or could require significant mitigation measures.

- Coastal-dependency: Some sites along the coast, including those of many existing coastal power plants, are designated in the applicable certified Local Coastal Program for coastal-dependent uses. Unless a desalination processing facility proposed for such a site is considered coastal-dependent, it could be considered a non-conforming use, which may require a change in the land use designation or other measures to allow it to be sited there. The intake and outfall proposed to be used by the desalination facility are more likely to be considered coastal-dependent [See Chapter 3.2.2.].

As a result of these concerns, it is likely that most, if not all, proposals to co-locate a desalination facility will need to be reviewed as if they will operate independently, since most will, at some time in their operating life, operate when the power plant does not. The review would include determining what effects the facility causes when it operates during a power plant shutdown, and may also involve partitioning responsibility for the environmental impacts and mitigation measures between the two facilities. This might best occur during CEQA review as a "reasonable worst case" evaluation of entrainment and brine discharge effects, or could also be part of review for a coastal development permit.

4.2 OTHER COASTAL ACT ENVIRONMENTAL POLICIES

As stated at the beginning of this chapter, many Coastal Act policies are likely to apply to desalination facilities similar to how they apply to other facilties. These include:

Spill Prevention and Response (Section 30253): Desalination facilities will likely be subject to the same spill prevention, response, and cleanup requirements as other similar industrial facilities in the coastal zone.

Hazards (Section 30253): Facilities should be sited in areas that allow minimi zation of risk due to geologic, flood, and fire hazard, and will not contribute to geological instability or erosion. This will require review of possible seismic, liquifaction, tsunami, and other site-related hazards.

Upland Habitats and Environmentally Sensitive Habitat Areas (ESHAs) (Section 30240): The review will likely evaluate the physical and biological effects of the proposed facility on surface water sources, riparian and wetland communities, special habitat sites, and other similar areas with high environmental values.

Public Access and Recreation (Sections 30211, 30212(a), and others): Desalination facilities proposed to locate near the coast will likely require evaluation to assess their effects on public access to the shore and their potential impacts on recreation.

Visual and Scenic Resources (Section 30251): Desalination facilities will be subject to the provisions of this policy, which require protection of coastal views, minimization of land form alterations, and compatibility with the character of the surrounding area. In some areas, this policy will also require enhancement of existing visual quality.

CHAPTER 5: OTHER REGULATORY ISSUES

Desalination facilities proposed for coastal areas will require review and permit approval under a number of different regulations. The specific requirements will vary, depending on the design and location of each proposal. The discussion below provides a general overview of the most likely necessary permits.

CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

Most proposals are likely to require fairly comprehensive environmental review, most likely through an Environmental Impact Report done under CEQA, and perhaps under the National Environmental Policy Act (NEPA), as well. A particular facility may be subject to a wide variety of permit requirements, depending on its design and location. This is likely to increase the importance that the initial environmental review under the California Environmental Quality Act be done thoroughly, and that agencies with jurisidiction be involved early and comprehensively.

5.1: AGENCIES WITH JURISDICTION

The list below includes agencies that are most likely to be involved in reviewing desalination proposals, along with a brief description of their likely involvement.

LOCAL JURISDICTIONS

Each local jurisidiction is likely to have unique review, permit, and approval requirements. Generally, desalination facilities proposed in the coastal zone will require coastal development permits both from the local jurisdiction, if it has a certified Local Coastal Program, and from the Coastal Commission[20]. Facilities will be subject to local zoning requirements, land use ordinances, growth management objectives, and other similar approvals, and will need to meet local requirements for public notices, public hearings, appeals, and other similar requirements. In addition to the primary local jurisdiction, most facilities will require approval from the local Health Department, and some sites will be under the jurisdiction of a local port district.

Additionally, some desalination facilities will be located within the Coastal Commission's appeal jurisdiction[21]. In these areas, a coastal development permit decision by the local jurisdiction may

[20] The Coastal Commission's retained jurisdiction is in coastal areas below the mean high tide line. Facilities proposed in areas of the coastal zone where there is no certified Local Coastal Program will be subject to review and permit requirements by the Coastal Commission.

[21] The Commission's appeal jurisdiction varies by locale, but is generally with 300 feet of mean high tide or between the sea and the first public road, within 300 feet of the top of coastal bluffs, within 100 feet of wetlands, streams, and other areas. Additionally, the Commission retains appeal jurisdiction over major energy facilities and major public works projects, so local decisions on many desalination facilities are likely to be appealable to the Commission, regardless of location in the coastal zone. [See Coastal Act Section 30603.]

be appealled to the Coastal Commission. In such cases, the Coastal Commission reviews the appeal to determine whether the local decision conforms to the applicable policies of the Local Coastal Program.

STATE

Desalination facilities will likely require permits or approvals from the following state agencies:

State Lands Commission: The State Lands Commission manages most of the state's tidelands and lands lying under coastal waters. Desalination facilities proposing to place new intakes or outfalls on state tidelands, or change the use of existing pipelines will generally be required to obtain a lease from the Commission. In these situations, since the Commission is representing the state as landowner, the lease must be included as part of a completed application to the Coastal Commission.

Department of Fish and Game: The Department requires a stream alteration permit for activities within inland waters and within some areas of bays and estuaries.

Public Utilities Commission: Desalination facilities may be subject to water rates established by the Commission.

State Water Resources Control Board (SWRCB): The SWRCB reviews and authorizes issuance of water rights in California. Water rights are required for consumptive uses from enclosed water bodies within the state. For proposed desalination facilities using water from the open ocean, water rights are likely not necessary. For proposed facilities using water from enclosed or semi-enclosed areas, such as bays or estuaries, or using saline groundwater, water rights may be necessary. Applicants and lead agencies should contact the State Board to determine whether a specific proposal will require a water right.

Regional Water Quality Control Boards: Each of the state's nine Regional Boards is responsible for water quality permitting within its region. Six of these Regional Boards are located, in part along the California Coast, and would regulate the discharges of desalination facilities within their jurisdiction. The two most common permits likely to be needed by a coastal desalination facility are:

- National Pollutant Discharge Elimination System (NPDES) permit: allows pollutants to be discharged in waters of the U.S. Desalination facilities using existing intake or outfall systems of already-permitted facilities, such as power plants or wastewater treatment facilities, may result in the need for any existing permits to be modified. A new desalination intake or outfall system is likely to require a new NPDES permit.

  For desalination facilities proposing to use a cooling water system of a coastal power plant, the RWQCB will review existing entrainment data as part of their NPDES analysis and may require an updated 316(b) study (see Chapter 4.2 Potential Impacts on Marine Environment).

- Section 401 water quality certification: This permit is required when proposing to place fill in a waterbody. It is issued by the state in conjunction with a Section 404 permit from the U.S. Army Corps of Engineers for placing structures in a waterbody (see below). These structures include structures such as intake or outfall pipelines, beach wells, transmission lines, or other similar structures. Desalination facilities involving new intakes or outfalls or requireing existing outfalls to be modified are likely to require a 401 water quality certification.

Department of Health Services: Equipment and processes used in desalination facilities will likely be subject to review and approval for use as drinking water.

Permits may also be required from:

- Air Quality Management Districts
- California Department of Parks and Recreation
- California Department of Transportation
- California Energy Commission

FEDERAL

Coast Guard: Structures in navigable waters may require approval to ensure they don't adversely affect navigation.

U.S. Army Corps of Engineers: A desalination facility may require a Section 404 permit from the Corps if it involves placing fill in navigable waters, and a Section 10 permit if the proposal involves placing a structure in a navigable waterway.

National Marine Fisheries Service and/or U.S. Fish and Wildlife Service:
Facilities may require review from these services for their potential effects on endangered, threatened, or other sensitive species. They may also require review for effects on protected marine mammals and migratory birds.

Permits may also be required from:

- U.S. Bureau of Reclamation
- U.S. Environmental Protection Agency
- U.S. Minerals Management Service (for equipment installed on OCS platforms)

BIBLIOGRAPHY

Buros, O.K. The ABCs of Desalting. International Desalination Association, February 2000.

California Department of Water Resources. The California Water Plan Update: Bulletin 160-98, January 1998.

California Resources Agency. California's Ocean Resources: An Agenda for the Future, March 1997.

Gleick, Peter, Gary Wolff, Elizabeth Chalecki, and Rachel Reyes. The New Economy of Water: The Risks and Benefits of Globalization and Privatization of Fresh Water. Pacific Institute for Studies in Development, Environment, and Security, February 2002.

Metropolitan Water District of Southern California. Request for Proposals for Participation in the Seawater Desalination Program, RFP No. WRM-3, November 28, 2001.

Ofiara, Douglas and Joseph J. Seneca. Economic Losses from Marine Pollution: A Handbook for Assessment. Island Press, Washington, D.C. 2001.

San Diego County Water Authority. 2000 Urban Water Management Plan. November 2000.

Shrybman, Steven. Thirst for Control. Council of Canadians, January 2002.

Urban Water Council. Public/Private Partnerships in Municipal Water and Wastewater Systems: Case Studies of Selected Cities. United States Conference of Mayors, February 2000.

Western Water. Tapping the World's Largest Reservoir: Desalination. Water Education Foundation, January/February 2003.

Yamada, Robert R., Jack K. Laughlin, and Dennis K. Wood. Co-located seawater desalination/power facilities: practical and institutional issues. In *Desalination*, 102 (pp. 279-286), Elsevier Publishing. 1995.

APPENDIX A: GLOSSARY AND ACRONYMS

Acre-foot (AF): A unit for measuring the volume of water. One acre-foot equals 325,851 gallons (the volume of water that will cover one acre to a depth of one foot). One million gallons equals 3.07 acre-feet.

Biocide: A chemical used to kill biological organisms (e.g., chlorine).

Brine: Water that contains a high concentration of salt. Brine discharges from desalination plants may include constituents used in pretreatment processes, in addition to the high salt concentration seawater.

Btu (British Thermal Unit): A standard unit for measuring a quantity of thermal energy, either electricity, natural gas or any other source of energy. One Btu is the amount of thermal energy required to raise the temperature on one pound of water one degree Fahrenheit at sea level.

Capacity Factor: An electric utility's annual capacity factor is defined as the annual kilowatt-hour sales divided by the product of the total hours in a year and the rated capacity of the utility in kilowatts.

Coagulation: A pretreatment process used in some desalination plants. A substance (e.g., ferric chloride) is added to a solution to cause certain elements to thicken into a coherent mass, so that they may be removed.

Cogeneration: A power plant that is designed to conserve energy by using "waste heat" from generating electricity for another purpose.

Deaeration: Removal of oxygen. A pretreatment process in desalination plants to reduce corrosion.

Distillation: A process of desalination where the intake water is heated to produce steam. The steam is then condensed to produce product water with low salt concentration.

Entrainment: Entrainment occurs when small organisms, such as plankton, larvae, and fish eggs, are drawn into a water intake past any screening equipment and are subjected to pressure or temperature changes. Entrainment is usually considered to result in the death of all the entrained organisms.

Feedwater: Water fed to the desalination equipment. This can be source water with or without pretreatment.

Impingement: Impingement occurs when fish and other aquatic organisms are trapped against screens used in intake systems. Impingement usually results in either injury or death to the organisms, although some systems use structures that allow some individuals to be moved away from the screens unharmed.

Infiltration Gallery: A method used for seawater intake. Perforated pipes are arranged in a radial pattern in the sand onshore below the water level. Water in the saturated sand enters the perforated pipes.

Kilowatt (kW): A thousand watts. The watt is a measure of power used by electricity generating plants. One watt is equivalent to 1 Joule/second or 3.4127 Btu/hour.

Megawatt (MW): A million watts.

Microlayer: The upper few millimeters of the ocean. The microlayer often contains dense concentrations of plankton, fish eggs, and other organisms.

Product Water: The desalted water delivered to the water distribution system.

Reverse Osmosis (RO): A process of desalination where pressure is applied continuously to the feedwater, forcing water molecules through a semipermeable membrane. Water that passes through the membrane leaves the unit as product water; most of the dissolved impurities remain behind and are discharged in a waste stream.

Scaling: Salt deposits on the interior surfaces of a desalination plant.

Total Dissolved Solids (tds): Total salt and calcium carbonate concentration in a sample of water, usually expressed in milligrams per liter (mg/L) or parts per million (ppm). The state-recommended Maximum Contaminant Level (MCL) drinking water standard for total dissolved solids is 500 mg/L, the upper MCL is 1,000 mg/L, and the short-term permitted level is 1,500 mg/L. Seawater contains roughly 30,000 mg/L.